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TREATMENT BY DIRECT DILATATION OF CICA- TRICIAL ŒSOPHAGEAL STRICTURE.

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It is not within the intent of the paper here presented to discuss the treatment of strictures of the œsophagus due to the presence in or about the gullet wall of malignant or benign neoplasms or of those due to syphilis, tuberculosis, or œsophagismus, nor does the writer intend that his remarks shall be held to apply to the treatment of stenosis due to external causes.

It is well known that the most common, if not the most extensive, strictures of the œsophagus are those occasioned by the cicatricial contraction following the destructive action of escharotics and the trauma produced by the impaction of foreign bodies. For the first few weeks after the swallowing of a corroding fluid, which may have immediately destroyed the mucous membrane or ignited an extensive ulcerative process, the passage of an œsophageal bougie of any sort must be regarded as an undertaking attended with considerable risk.

It is questionable whether it is justifiable at such a time to attempt the introduction of any dilator. The use of the

slightest force under such conditions is certainly strongly to be condemned. Following the ulcerative stage, however, the œsophageal wall undergoes certain rather constant changes which render the passage of soft bougies in careful hands less dangerous than is generally believed.

The intelligent introduction of a bougie for the treatment by dilatation of a cicatricial stricture of the œsophagus implies the previous exclusion of the possibility of the presence of aneurism, neoplasms, syphilis, tuberculosis, or abscess. That is to say, the intelligent treatment by dilatation of cicatricial stricture presupposes a correct diagnosis.

Since they premise certain more or less original theses pertaining to treatment, which the writer wishes to submit, it is for the sake of clearness desirable to review a few points relating to the pathology of cicatricial œsophageal stricture.

Concerning fibrous or organic stricture occurring as a sequence of ulceration caused by the swallowing of caustic or hot fluids, Greig Smith (Vol. i, page 465) states that "the stricture usually begins high up in the gullet and extends a considerable way downward. It is very rarely annular. The mucous membrane is replaced by a gray or bluish-gray tissue of a peculiarly hard and resistant nature. The muscular layer is rarely involved. The passage through the stricture is devious, but not to such an extent as in carcinoma."

Tillmans (*Lehrbuch der Chirurgie*) is authority for the statement that after deep destruction by caustics the œsophagus is transformed into very thick cicatricial tissue. Von Ziemssen likewise invariably found the dilated wall of the œsophagus above the cicatricial stricture much thickened.

Richardson (Dennis's "System of Surgery") says that "the muscular coats are hypertrophied in stricture of the œsophagus. This hypertrophy appears early. It is especially marked in the circular fibres, is greatest close to the stricture, and extends for some distance above it."

Cicatricial strictures are dense and unyielding. They tend to contract progressively without deep ulceration; and whereas the œsophagitis corrosiva immediately following the swallow-

ing of an escharotic may weaken the gullet wall to a greater or less degree, with the development of scar tissue at the site of the stenosis as well as above and below the strictured segment, and with the development of muscular hypertrophy, the wall of the œsophagus in most cases becomes really tougher than in the normal state.

The presence of a diverticulum presupposes some pathologic change in the œsophageal wall (usually a hernial protrusion of the mucosa through the separated fibres of the inferior constrictor muscle). Diverticulum will hardly be expected to follow the deglutition of an escharotic unless the destructive action be great enough to lead to peri-œsophageal phlegmon. Such cases, being in nearly every instance rapidly fatal, are certainly very rarely presented to the surgeon as œsophageal strictures for treatment by dilatation or otherwise. In 100 autopsies after œsophageal stricture, Von Hacker found seven diverticula, all the result of peri-œsophageal phlegmon produced by the same traumatic agent that caused the stricture. Were diverticulum present as a complication of organic cicatricial stricture, a bougie might with little force be thrust through an area thus weakened. It is therefore fortunate that the combination of diverticulum with old cicatricial stricture is rare.

In Fig. 1 is seen an œsophagus strictured from the crossing of the bronchus almost to the cardia. The wall of the œsophagus is thickened from the cricoid cartilage to the stomach. The wall of the sacculated portion above the stenosis showed upon microscopical examination marked muscular hypertrophy. This, so far as the thickening is concerned, is a rather typical gross pathologic specimen of cicatricial stricture of the œsophagus. The danger of thrusting a flexible sound through the hypertrophied coats of this gullet would be slight,—that is, the danger of perforation incident to the passing of bougies would not be increased, but decreased, by the thickening and toughening of the œsophageal wall.

In Fig. 2 is represented a section from a normal area of the œsophagus in a case of stricture. The section shown in

Fig. 3 is taken from the œsophageal wall in the same case, near the site of stenosis. Each section is magnified eighteen diameters. It will be seen, therefore, that, owing to the muscular hypertrophy, the œsophageal wall near the stricture is twice as thick as in the normal state.

In Fig. 4 is shown a section of the same œsophageal wall at the site of stricture. The mucosa, as will be observed, has been destroyed and removed by the escharotic. This section is magnified only eleven diameters, from which it appears that the œsophagus even at the site of the stricture with the mucosa destroyed is quite twice as thick as in the normal segments. It is also somewhat toughened by the presence of scar tissue. In Fig. 5 (a section taken from the same œsophagus) may be seen large cells with large polar nuclei, Unna's plasma cells, the presence of which indicates the development of new connective tissue.

Various transitional forms of young connective-tissue cells are abundant in the submucosa above and below the site of stenosis.

To surgeons who have made gastrostomy for the relief of the distressing symptoms resulting from œsophageal stricture, the importance of persistence and patience in the attempt to accomplish the re-establishment of the œsophageal lumen by direct dilatation will be apparent. Since, in cases of cicatricial stricture, the gastrostomy is made with the view of utilizing the gastric fistula as an avenue of approach to the stricture for the practice of retrograde dilatation, it will be seen that the methods of Ssabanajew, Hahn, Frank, Witzel, and De Page, with their great advantage, so far as feeding is concerned, of providing a valve, are hardly applicable if the stricture is to be gradually dilated from below.

It would likewise be difficult to perform retrograde dilatation through the funnel-like invaginated depression in the stomach wall, after the performance of gastrostomy according to Stamm, without destroying the adhesions which make the Stamm operation efficient, that is to say, repeated stretching of the nipple-like invaginated canal would in time cause leakage.



FIG. 1.—Extensive stricture of the esophagus showing thickening of esophageal wall throughout the whole length. The wall of the sacculated portion showing considerable thickening.



FIG. 2.—Section of normal portion of the esophageal wall in a case of stricture. Magnified eighteen diameters.



FIG. 3.—Hypertrophied wall of same œsophagus above stenosis. Magnified eighteen diameters.



FIG. 4.—Section at site of stenosis of œsophagus shown in figure. Mucosa removed by escharotic. Magnified eleven diameters. The œsophageal wall is here markedly thickened.

If a stricture at or near the cardia can be dilated rapidly, completely, and safely at one operation, gastrostomy or gastrotomy must, it is clear, be regarded as operations distinctly preferable to direct dilatation, as they certainly must be in all cases of stricture of the œsophagus impassable by direct dilatation and in cases in which it is absolutely impossible to nourish the patient through a narrow and devious, though perhaps passable, canal in the œsophagus.

An important fact, upon which too much stress cannot be placed, is this,—gastrostomy in stricture of the œsophagus is only a palliative operation. The stricture still remains to be cured, that is, to be dilated or sawed or cut; and in the belief that, after all, direct dilatation with the attendant and consequent pressure absorption, whether induced by sounds, electrolysis, laminaria pencils, or what not, is at last our only really curative resource in stricture of the œsophagus, the writer submits for consideration photographs and descriptions of new instruments for the direct dilatation of œsophageal stricture; and, while he certainly does not wish to dogmatize upon so important a subject, submits further herewith his belief that by their use a certain percentage of so-called impassable cicatricial strictures may be entered and dilated, and the use of ordinary œsophageal bougies, laminaria pencils, and electrodes made possible.

Persistent effort with these instruments has made it possible, in several cases of what had been pronounced by surgeons of varying skill and experience to be impassable strictures, to nourish the patient and cure the stricture without gastrostomy.

It is very well known that whereas rectal alimentation and the use of a hernia pad after simple gastrostomy, as suggested by Taylor and others, may give some aid in sustaining the declining patient, it cannot be denied that a certain percentage of cases operated by simple gastrostomy for retrograde dilatation must succumb at length to starvation in spite of the most zealous efforts at maintaining nutrition, for the reason that after simple gastrostomy food cannot be easily retained in the stomach, but is expelled with each descent of the diaphragm.

In the writer's experience, gastrostomy in cases of cicatricial stricture of the œsophagus has been useful as a step towards immediate retrograde dilatation of an impassable stricture at or near the cardia, and for the establishment of a water-tight valve-closed canal through which the patient may be fed while a stricture of the upper or middle portion of the œsophagus is being opened by direct dilatation.

Gastrostomy, as a preliminary step in the application of such methods of treatment of gullet stricture as those of Ochsner and Abbe, is of course indispensable.

In children the performance of gastrostomy is not without considerable danger, and their nutrition through a gastrostomy tube is difficult.

Contrary to the experience of others, the writer has found it easier to dilate œsophageal strictures in infants and small children than in larger children and nervous and rebellious adults.

In most cases of cicatricial stricture, a gradual narrowing of the dilated segment above the stricture guides the entering bougie directly into and through the contracted lumen. It not infrequently happens, however, that cicatricial contraction so changes the relations that the lumen is not in the centre of the hypertrophied mass. Often the passage is not only narrow but devious.

The extent of strictures in the transverse and long diameter is very variable. Many include the entire periphery of the organ, but others take in only part of it. In such strictures as obstruct the lumen of the gullet with a large irregular mass presenting great dilatation or sacculation above the stenosis, or those in which the lumen is displaced from the centre of the organ, the passage of instruments, except by chance, is often impossible.

It is in the dilatation of strictures of this sort that a malleable or dirigible bougie offers a distinct advantage. (Figs. 6 and 7.) The position in the gullet of a hard-rubber olivary-bulb dilator attached to a springy whalebone shank cannot be controlled by the operator. As will be clear when

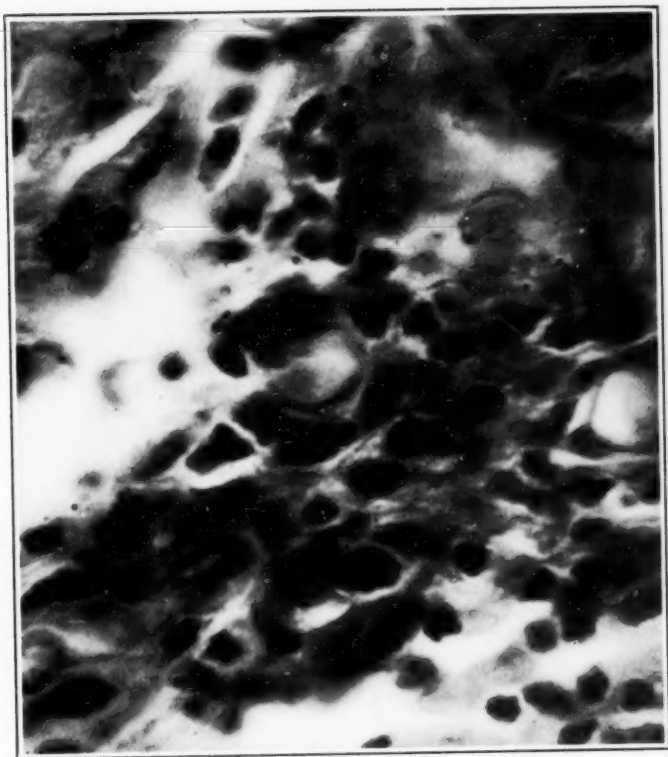
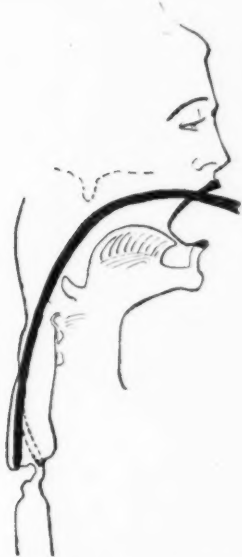


FIG. 5.—High power showing Uma's plasma cells in muscularis.

the shape and relations of the œsophagus are recalled, a bulb upon the end of a springy handle must pass along the posterior wall of the gullet in the upper segment and then across to the anterior surface as the lower extremity is approached. Cracour's spiral wire and metal-tip bougie and the English silk-web and gum dilators are open to the same objection.

FIG. 6.



Illustrating advantage of malleable bougie in stricture of the œsophagus, cicatricial contraction having displaced lumen towards anterior wall.

The surgeon occasionally encounters stricture of the œsophagus from a fold of the mucous membrane. There is such a specimen in the museum of the College of Surgeons, London.

Rokitansky (Path. Anat., Vol. ii, page 8) reported cases in which the mucosa had been destroyed by the energetic action of an escharotic and replaced by fibrous tissue, giving rise to peculiar valvular strictures of the œsophagus, somewhat analogous to those of the bowel consequent on dysentery.

It is unnecessary to multiply instances of these peculiar forms of contraction to show that in certain cases, at any rate,

a malleable bougie to which one may give any desirable curve and the direction of whose tip may be controlled will serve a useful purpose. These bougies are of spiral-wound steel wire, filed flat and smooth, and contain a withdrawable soft lead core. They are made in various lengths and diameters.

If a fold of mucosa or a transverse band of scar tissue upon the posterior surface of the canal obstruct the passage of the instrument, the tip may be curved so that it must pass along the anterior surface, and *vice versa*. The core is so soft as to practically eliminate the danger of trauma to the œsophageal mucosa or perforation. The malleable core is withdrawable, and may easily be removed when the tip of the instrument has passed the stricture. The lead core makes it possible to readily determine the position of the sound while in the œsophagus by the use of the X-ray. The skiagram (Fig. 8) showing the metallic dilator occupying the œsophagus was made to determine whether the instrument really passed the stricture in this case and entered the stomach. Insomuch as it was not possible to enter the strictured segment with dilators other than one screwed to the butt of a filiform, a question arose as to whether the dilator did not merely coil up in the sacculum above the stricture. The X-ray promptly cleared up this doubt. This could hardly have been decided so easily had the dilator not been constructed of metal.

A large sound of this type may occasionally be readily passed through a strictured lumen which does not permit the entrance of very small ordinary bougies in skilful hands.

One of these instruments is shown in Fig. 9. Several filiforms, fifteen inches long, of the sort also shown upon this plate, are introduced into the œsophagus, some bent, some twisted cork-screw-like, some straight. In most cases of stricture, after to and fro and twisting manipulation of these filiforms, one after another for a longer or shorter time, one will slip through the strictured segment. The other filiforms are then withdrawn. The spiral-wound flexible metallic bougie may then in many cases be introduced by screwing its small threaded end to the threaded butt end of the filiform and push-



FIG. 7.—Soft malleable esophageal bougie of web-silk containing withdrawable lead core.

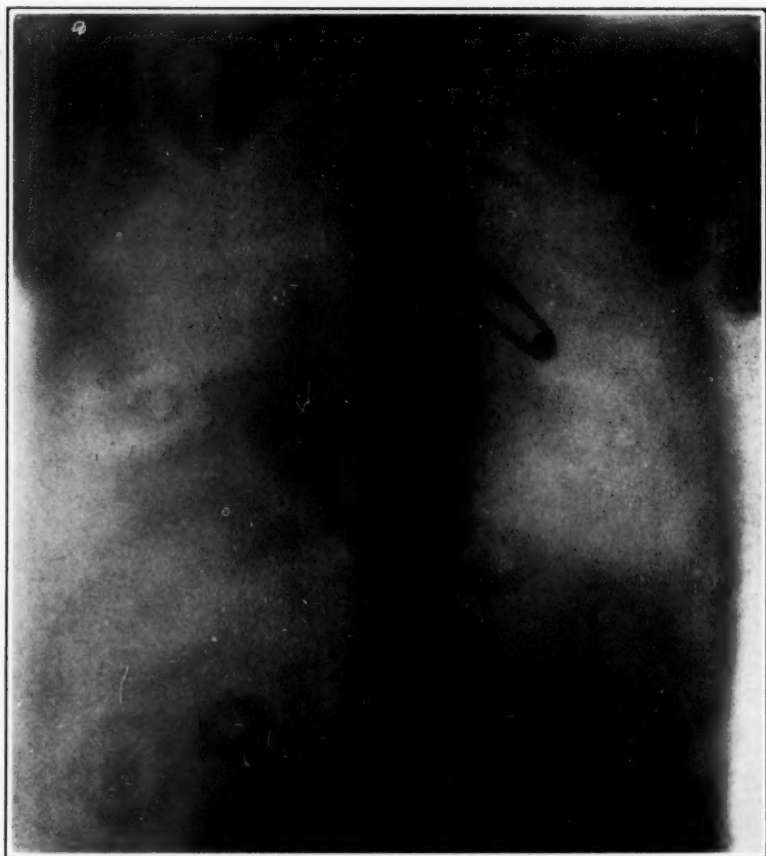


FIG. 8.—Skiagraph showing author's spiral-wound-wire dilator in strictured œsophagus (attached to filiform guide). The picture is taken from the back, therefore shows liver upon the right side. The normal curves of the œsophagus are described by the bougie.

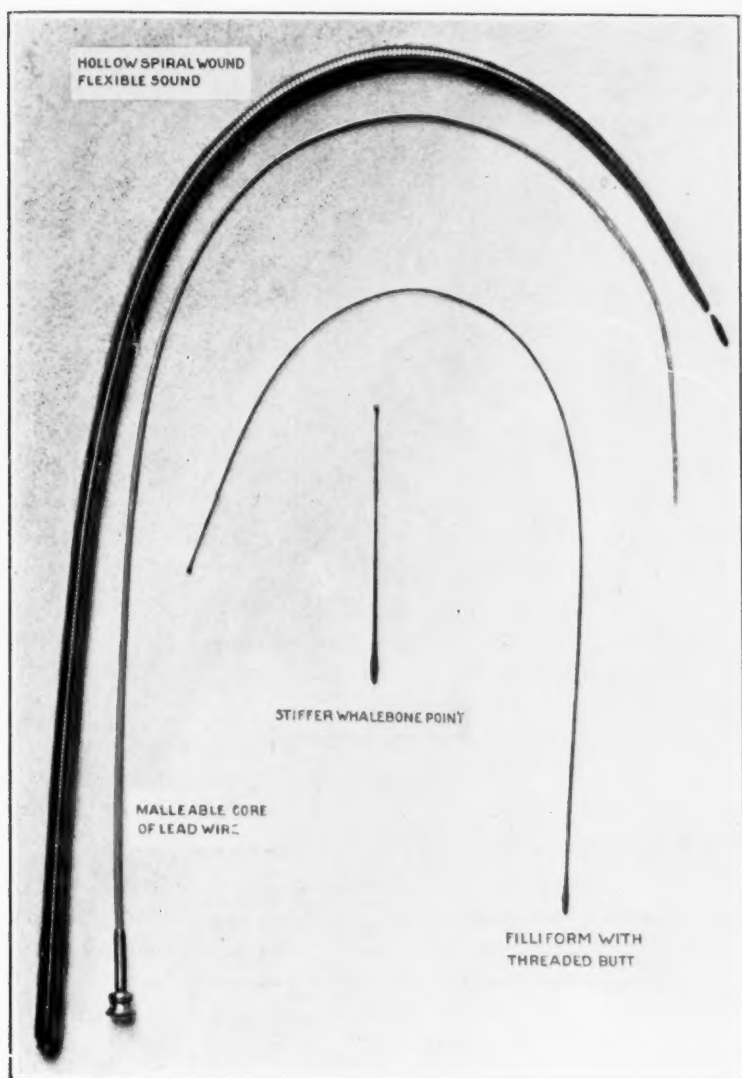


FIG. 9.—Wound wire malleable bougie and whale-bone guides.

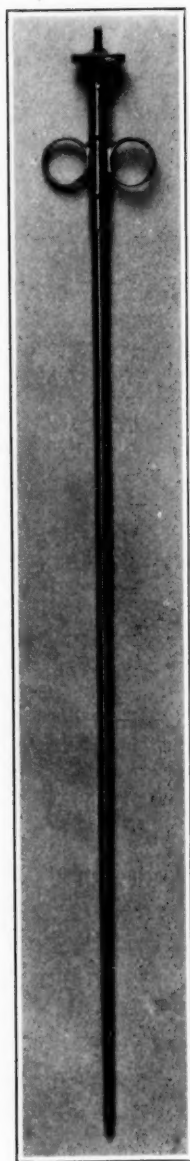


FIG. 10.—Flexible dirigible metallic esophageal bougie.

ing it gently into the œsophagus with or without the lead core, according to the resistance offered by the stricture. The filiforms, being soft and flexible, curl up in the stomach with no trauma to the gastric mucosa.

The writer is at present dilating a valve-like stricture of the œsophagus in a boy two years of age, in which after months of regular dilatation it is not possible to introduce any other instrument than one of the kind just described. In this case, after manipulation of the filiforms for a few minutes, one can always be made to engage the stricture and pass readily into the stomach. A relatively large-sized metallic bougie attached to the butt end of the filiform will readily follow the latter through the œsophagus, the filiform curling up in the stomach.

The shorter and stiffer filiform point shown in Fig. 9 has been successfully used to guide the metallic dilator through a tight stricture at the level of the diaphragm. In this case a gastrostomy and unsuccessful attempt at rapid retrograde dilatation had been made. Under gradual direct dilatation, this stricture is yielding. The patient swallows readily fluids and semisolids after three months of sounding. In Fig. 9 is shown a short hard-rubber tip which may be screwed to the threaded hollow end of the metallic bougie when the latter is to be used as an ordinary sound. To render the instrument malleable, the lead-wire core is introduced.

The writer has also fashioned a dirigible sound (Fig. 10), the distal end and tip of which may be moved at will, while the instrument lies in the œsophagus, by the manipulation of an adjustment screw at the proximal extremity. This is made of two tapering bands of watch-spring steel welded together at the distal extremity or point. They are covered by flat wound wire. One of these bands is fixed to the handle of the instrument near the adjustment screw, the other band is attached to a half and full-round threaded bar which passes through the screw. By manipulation of the adjustment screw, the second band can be made to slide along the first, forward or backward, so as to move the tip in either of two directions. With this

instrument, which is light and quite flexible, it is possible to explore the bottom of a sacculum and enter an œsophageal lumen which would otherwise be difficult to discover.

Bulbous sounds for the œsophagus are open to such objections as apply to bulbous sounds generally. Like the urethral "bougie-à-boule," they are useful in locating strictures, but are of little value as dilators. It is almost impossible to cause a bulb to lie in the grasp of a small stricture. It may be brought without difficulty to the proximal margin, and may be pushed to the distal side, but is only with great difficulty held in the contracted segment. It is not easy to secure with them the absorption produced by continued gentle pressure.

The swallowing of weak cocaine or adrenalin solution will usually, by virtue of the vascular depletion produced by those agents, facilitate the introduction of any œsophageal sound. The cocaine solution will also in most cases relieve nausea and prevent spasmodic and violent reversed peristaltic efforts, which may render the passage of instruments wellnigh impossible in an otherwise passable stricture. The local anæsthesia is also, for obvious reasons, of considerable value, especially in children.

We are generally advised to incline the head of the patient backward before introducing a sound. The writer has found it distinctly advantageous to enter the œsophagus with the head tilted forward. The tissues of the neck are more relaxed in the latter position.

Not all of the varieties of œsophageal stricture may be successfully treated by dilatation; yet it is doubtful whether the sound is not useful at some time in every case of cicatricial stricture.

DIVERTICULA OF THE ŒSOPHAGUS.

WITH THE REPORT OF A CASE.

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THE term diverticulum is properly applied only to a circumscribed pouch-like protrusion or bulging involving a limited part of the circumference of the œsophagus, and should not include sacculated dilatation of the whole tube that occurs above strictures or from paralysis of its muscular wall. Neither should abscess cavities communicating with the lumen by fistulous tracts, nor defects in the wall from ulceration and cicatrization, which permit of slight sacculatation of the œsophagus, be included under this head. The characteristic features of a true diverticulum are that they are sharply defined, pouch-like protrusions of the œsophageal wall, lined with a normal or but slightly altered mucous membrane. Ulceration of the inner surface of the pouch is but rarely found. As a result of long-continued irritation from imprisoned foreign matter, degenerative changes with papillary or carcinomatous outgrowths sometimes occur.

As there is no sharp line of demarcation between the pharynx and the œsophagus, it would not be possible to consider diverticula of the œsophagus without discussing those of the pharynx. Among the cases reported in the older literature, many that would now be classed as pharyngeal were described as belonging to the œsophagus. This was in part due to the inaccuracy of the observer, and in part to the uncertainty as to what constitutes the lower limits of the pharynx. Again, by far the greater number of diverticula have their point of origin at the junction of the pharynx and œsophagus, and may with propriety be considered as belonging to both.

The difficulty in determining whether these border-line cases properly belonged to the pharynx or œsophagus led Starck to group them as pharyngo-œsophageal, and Rosenthal as "Grenz" diverticula. The anatomical landmarks by which the pharyngo-œsophageal junction may be determined are still a matter of dispute. The older writers were satisfied to consider the point at which the respiratory and alimentary tracts became distinct as indicating the beginning of the œsophagus. Others consider that the characteristic arrangement of the musculature, the inner circular and the external longitudinal layers, indicate the termination of the pharynx and the beginning of the œsophagus. By some the smallest part of the tube is considered the point of division. At the present time, most writers fix the upper limit of the œsophagus at a point corresponding to the lower border of the cricoid cartilage. As all of these are subject to considerable variation, it is therefore difficult, excepting after the most painstaking investigation, to determine the starting-point of some diverticula. For all practical purposes, the pharyngo-œsophageal junction may be considered as on a level with the lower border of the cricoid cartilage. This point will also in most cases mark the narrowest part of the tube. In children the upper limit of the œsophagus is slightly above this, while in the aged the œsophagus may be dragged down so that it is considerably below the cricoid cartilage.

The history of diverticula of the œsophagus dates from the publication of a paper by Mondiere,¹ in which we find the first accurate description of this condition.

Following this publication, Rokitansky, in 1840, classified them from an etiological stand-point into two groups. First, those that are due to traction from without exerted upon a portion of the œsophageal wall; and, second, those that result from pressure from within. The first group he called traction and the second pulsion or pressure diverticula. This classification has been followed by all writers since his time, and his work, dealing mostly with the first group, has up to the present time constituted our chief source of knowledge of traction diverticula. Zenker² was the next to bring this subject into promi-

nence. His contribution, based upon the study of thirty-four cases, of which twenty-two had come to autopsy, constitutes a fountain from which all subsequent writers have freely drawn. In this masterly work we find the first careful study of the pathogenesis and symptomatology and clinical significance of pressure diverticula.

Since the publication of Zenker's work many contributions to this subject have appeared. The most important of these are the theses of Oekonomides,³ Starck,⁴ and Rosenthal.⁵ The latter is by far the most complete contribution to this subject that has appeared since Zenker's work was given to the profession.

Following the classification of Rokitansky, Zenker described but two groups: Traction and pressure diverticula. A third distinct and important group has been added by Oekonomides,—the traction-pressure diverticula. In this form we have a traction diverticulum enlarged by pressure from food accumulating within its cavity, causing it to acquire a pathologic importance equal to the pressure diverticulum described by Zenker.

Little importance is ascribed by Rokitansky, Zenker, and their followers to traction diverticula. In most cases they seem to cause no symptoms during life by which they can be recognized, and are only rarely found post-mortem. A more careful examination of the œsophagus would undoubtedly show them to be more common than the autopsy reports of the past would indicate. Traction diverticula are generally the result of traction made by the shrinkage of scar tissue that is attached to the œsophagus. The contraction commonly follows an inflammation originating in a bronchial lymph gland at or near the bifurcation of the trachea. It may also be the result of an inflammation spreading from the pleura or pericardium to the œsophagus and its surrounding areolar tissue, or through the pleuro-œsophageal muscle of Hyrtl. This mode of origin explains their situation on the anterior wall of the œsophagus, and also their frequency in children and in tubercular subjects. They are generally small funnel-shaped recesses, having for

their wall either all of the tunics of the œsophagus or its mucous membrane alone. Their direction is, according to Zenker, mostly horizontal or oblique, with the orifice of the pouch directed downward. The direction of the lumen of the sac, with the slight chance afforded for arrest and retention of food particles, explains the absence of the clinical symptoms common in pressure diverticula.

In a case reported by Chiari,⁶ a traction diverticulum developed from contraction of the scar tissue connecting a degenerated goitre with the œsophagus. A few cases undoubtedly have been observed where no scar tissue or evidence of an antecedent inflammation could be demonstrated. These are to be explained by the presence of the tracheo-œsophageal and pleuro-œsophageal muscle, that binds together the œsophagus and trachea and the œsophagus and pleura. The presence of this muscle with unequal displacement of the trachea and œsophagus could, by producing traction upon the œsophagus, cause a diverticulum at its point of attachment. Inflammatory processes, spreading from the trachea, bronchi, or the pleura, to these muscles, may also from subsequent contraction be the cause of a diverticulum, as was shown by two specimens examined in serial sections by Riebold.⁷ Although traction diverticula are generally regarded as of slight importance, they may by perforation of the diverticular wall become a serious menace to life. Rokitansky recognized this danger, and reported a fatal case of perforation of a diverticulum. When perforation occurs, it is either from a sharp foreign body lodged within or through ulceration from pressure or retained food. A case is reported by Coester,⁸ where the sac was penetrated by a sharp spicule of bone which entered the vena cava and caused a fatal hæmorrhage. Other cases are reported in which the aorta and vena cava have been injured by sharp bodies lodged in a diverticulum. Zenker reports two cases, one of his own and one of Merkle's, in which sudden death was caused by penetration of the pulmonary artery by sharp pieces of bone that had lodged in a traction diverticulum. Death may also be the result of perforation of a diverticulum with subsequent infec-

tion of the mediastinum, pleura, or pericardium. In fact, when death results from the presence of a traction diverticulum, it is generally from infection of the mediastinum or from a gangrenous pneumonia. Occasionally a bronchus is perforated, causing a fatal septic bronchitis. Zenker mentions a case of a woman sixty-six years of age who died of an obscure disease. The autopsy revealed a double gangrenous pneumonia, with a perforation of the right bronchus, communicating with an abscess of the mediastinum, into which, on the opposite side, opened the diverticulum of the œsophagus.

Aside from the dangers incident to perforation of a traction diverticulum, in a few cases they become of great clinical importance by being converted into pressure diverticula from the arrest of food particles and the consequent distention of the sac from pressure and traction. This occurred in eight of 133 cases of traction diverticulum, according to Rosenthal. To this group Oekonomides has given the name of traction-pulsion diverticula. They are situated, as are traction diverticula, on the anterior wall of the œsophagus, and generally near the bifurcation of the trachea. Unlike the latter, however, they are of the greatest clinical importance, and give rise to symptoms quite as distinct, when of the same size, as those that are primarily caused by pressure. Of this group Rosenthal was able to find nine cases reported in the literature, the first being by Tiedemann, in 1875. In three of these the sac was of large size, from four to seven centimetres in depth, and pear- or egg-shaped, resembling in structure pulsion diverticula. In one (Tetans⁹) the orifice of the sac was three and one-half centimetres below the cricoid cartilage, and in a second the fundus was found the same distance above the cardia.

Traction diverticula which are always of small size cause no symptoms during life by which they may be recognized. Difficulty or delay in swallowing granular foods, such as rice or corn, may be sufficient to attract attention, according to Tiedemann.¹⁰ If the sac causes the arrest of food, it soon becomes enlarged, and is then a traction-pulsion diverticulum with the symptoms in the main of a pulsion diverticulum. Dys-

phagia, however, has not been an early symptom in the cases reported. In the case of Scherpenburg,¹¹ pressure of the sac upon the left subclavian produced a change in the volume of the left radial pulse. Regurgitation, vomiting, dyspnœa, and pain from pressure when the diverticulum is filled are symptoms common to this group and to pressure diverticula. Death from inanition is almost a constant termination in traction-pulsion diverticula. Relief from surgical procedures is impossible on account of the deep location of the sac.

Pressure or pulsion diverticula, unlike those caused by traction, always produce symptoms by which they may be recognized during life. Although not so common as the latter, they are of far greater interest to the practitioner. First, because of the difficulty encountered in making a correct diagnosis, and, second, because the condition, if not relieved by surgical means, will ultimately destroy the life of the patient. Of the twenty-seven cases reported by Zenker, in which the diagnosis was verified by autopsy, thirteen died from starvation and eight from intercurrent diseases, superinduced by the diverticulum. In six the cause of death was not mentioned in the report.

For convenience of description, and because of the difference in the clinical importance, mode of development, and variation in the symptoms produced, pressure diverticula may be grouped into

1. Those of the pharynx proper.
2. Those at the pharyngo-œsophageal junction, the borderline cases, or Grenz diverticula of Rosenthal.
3. Diverticula having their origin in the middle third of the œsophagus somewhere near the bifurcation of the trachea, and mostly just above the left bronchus. This is the epibronchial group of Leutgert.¹²
4. The deep-seated diverticula; those in which the origin is below the level of the left bronchus, with fundus a variable distance above, but usually near, the diaphragm. These have been termed epiphrenal diverticula, because most of them are given off from the œsophagus a short distance above the dia-

phragm with the fundus of the pouch resting upon it. These diverticula of the first group are found mostly on the lateral wall of the pharynx and rarely on the posterior median aspect, as are those of the pharyngo-œsophageal junction. Most lateral pharyngeal diverticula are congenital, probably originating from the remains of the third and fourth branchial clefts, the starting-point being an incomplete internal branchial fistula that has from pressure from within gradually dilated and assumed the characteristic shape of a diverticulum. Koenig and Es-march considered this to be the mode of origin of all diverticula of the pharynx and also of the pharyngo-œsophageal region. While the possibility of an internal fistula offers a plausible explanation of the first group, it must be admitted that it has never been conclusively demonstrated by dissection. In these cases in which the symptoms of a diverticulum date from early childhood, it is possible that the presence of a congenital defect will explain their early onset. This defect may be either an internal branchial fistula or a congenital pouch-like recess in the postero-lateral pharyngeal wall, such as occur normally in certain lower animals; *e.g.*, the pig, camel, and elephant. Congenital stenosis of the œsophagus may also be the cause of the early symptoms, and may be an important factor in causation of a diverticulum.

In the case reported by Heusenger,¹³ in which the symptoms began in early childhood, the position of the sac would make it appear as if the diverticulum originated in a branchial fistula. In this case the patient, a man aged sixty-seven years, had suffered from earliest childhood from dysphagia and regurgitation of food. On examination, no difficulty was found in passing a sound into the stomach. The finger could be passed into a sac which lay to the right of the base of the tongue, and which contained a large quantity of mucus and remains of food taken some days before. By pressure upon the lateral walls of the pharynx, the pouch could be emptied. Another case similar to this in which the symptoms began in early life is reported by Bartelt.¹⁴ This case, although reported as a diverticulum of the œsophagus, probably was of pharyngeal origin.

Trauma, causing a weakening or rupture of the muscular wall of the pharynx, may be an important factor in the development of a diverticulum. In the case reported by Klose and Paul,¹⁵ injury to the pharynx by a fish-bone which lodged in the throat was considered by them to be the cause of the diverticulum. In this case the fundus of the sac lay four centimetres under the isthmus of the fauces on a level with the cricoid cartilage. The orifice was one and one-half inches higher behind the isthmus. The capacity of the diverticulum was about four drachms. Although the symptoms characteristic of a diverticulum dated from the time of injury in this case, their relation to the accident might be explained by assuming that a diverticulum or a congenital malformation existed at the time, and that the foreign body lodged within the cavity had first directed attention to its presence.

Excessive pressure within the pharynx from long-continued blowing on wind instruments, or from shouting, may, in case the pharyngeal wall is weakened from previous disease, cause a dilatation of a part of the pharynx that later, from accumulation of food, becomes a diverticulum. In others the pressure may cause a separation of the fibres of the pharyngeal muscles, and a hernia of the mucous membrane may result, which subsequently, from retention of food, may become a pulsion diverticulum. In a case reported by Wheeler,¹⁶ an officer, after an attack of erysipelas which involved the throat, gradually developed a tumor on the right side of the neck under the sternomastoid muscle, which increased in size when the pressure within the pharynx was increased, as in shouting. The voice was hoarse and uneven, and cough was troublesome. The patient was operated upon, and the sac, which was of mucous membrane alone and which pressed upon the right recurrent laryngeal nerve, was excised and the pharynx closed. Recovery with complete control of the voice followed.

The symptoms occasioned by lateral pharyngeal are on the whole similar to those of pulsion diverticula of the œsophagus. Dysphagia, however, is not so constant nor so troublesome as in the latter. Cough and dyspnœa from the contents of the

sac escaping into the air-passages, and from pressure upon the larynx, or upon the recurrent laryngeal nerve, have been the most characteristic symptoms in the cases reported. As a rule, the diverticulum does not obstruct the œsophagus to any considerable degree, and therefore the patient does not suffer from inanition, as in œsophageal diverticula.

Pharyngo-œsophageal pulsion diverticula are the most common as well as the most important from a pathologic and clinical stand-point. The etiology of many is yet unsolved. They develop exclusively in the median line posteriorly. At times from traction, as the sac grows larger and is compressed against the vertebral column, they are dragged to one side, usually to the left, the fundus being in relation to the lateral wall of the œsophagus. In the course of development of the pouch, the œsophagus is also displaced, so that the axis of the pharynx and the orifice of the diverticulum are in a line, permitting easy entrance of food into the sac and obstructing the lumen of the œsophagus. Their point of origin corresponds to a triangular space just below the inferior constrictor, where, by the separation of the longitudinal muscular bands of the œsophagus and the absence of circular muscular fibres, there is normally a defect in the muscular wall of the œsophagus. This point of least resistance in the œsophagus has been called the Lainer-Hackermann¹⁷ point. It is here that the separation of the muscular fibres takes place with the greatest ease. Above this the interlacing fibres of the superior constrictor and below the circular, inner, and the longitudinal outer muscular layers are capable of withstanding pressure from within. At this point the œsophagus is also narrowest and fixed in front by its relation to the cartilaginous larynx, so that any increase in pressure within its lumen must unequally distend its posterior wall. In case of arrest of an unusually large bolus of food or of a foreign body, it is this weak point that bears the impact. It is thus readily seen that a foreign body lodged here may separate the muscular fibres and produce a hernia of the mucous membrane, which later develops into a diverticulum. A number of cases are reported where the symptoms of a diverticulum followed close

upon the arrest of a foreign body, such as a piece of bone, in this part of the œsophagus. Aside from injuries from ingestion of large masses of food or a hard foreign substance, it is possible for lesions of the muscular wall of the œsophagus from trauma from without to be the immediate cause of diverticulum. A case of this kind is reported by Freiberg.¹⁸ The patient, an officer, was thrown from his horse during some military manoeuvres and sustained an injury to the head, from which he remained unconscious for twenty-four hours. After regaining consciousness, a swelling was observed between the trachea and the sternomastoid muscle. He immediately complained of dysphagia, which gradually increased with the onset of other symptoms of a diverticulum, although the swelling disappeared. The symptoms of obstruction continued until death from inanition took place. As a result of the accident, a laceration of the wall of the œsophagus had occurred, which was immediately followed by the development of a pressure diverticulum.

A case similar to Freiberg's has recently been reported by Schlesinger.¹⁹ In this the patient, a male of sixty-seven years, fell from a scaffolding fifteen years before he presented himself for examination. Immediately after the accident he experienced difficulty in swallowing, which later became serious. Œsophagoscopic examination showed the sac twenty-three centimetres from the incisor teeth. Measurements of the contents of the sac showed its capacity approximately 250 centimetres. The patient subsequently died from an acute pneumonia. Autopsy showed that the diverticulum had its origin at the pharyngo-œsophageal junction, and that its orifice was dragged downward two and one-half centimetres below the cricoid cartilage, and was seventeen and one-half centimetres from the line of the teeth. The sac measured six centimetres in both its vertical and transverse diameters. Its inner surface was somewhat eroded, and at one point a small warty excrescence was found, which, on histologic examination, proved to be carcinoma. Schlesinger considers that the fall caused a rupture of the œsophagus. This view is supported by the occurrence of a slight hæmorrhage at the time of the injury.

Cicatricial stricture of the Œsophagus, although but rarely associated with diverticula, yet occasionally bears a causal relation to this condition, as is shown by a few recorded cases. One of this kind is reported by Nicoladoni.²⁰ A child of eight had two years before swallowed a solution of caustic soda which caused a stenosis of the Œsophagus. Shortly afterwards the characteristic symptoms of a diverticulum developed. To permit feeding, the Œsophagus was opened by lateral incision and a tube introduced into the stomach. The patient died eight days later of bronchopneumonia. The autopsy showed a cicatricial stricture of the Œsophagus just below the cricoid cartilage. Immediately above the stricture the Œsophagus was dilated, and from the posterior lateral wall a typical diverticulum was given off. A similar case was reported by Braun.²¹

Congenital strictures of the Œsophagus when found are often situated at the upper limit of the Œsophagus. When the symptoms of a diverticulum of this region date from early childhood, the presence of a congenital narrowing of the Œsophagus offers the most rational explanation of their origin. An interesting case of a diverticulum that was situated immediately above a non-traumatic stricture is reported by Richardson.²² In this a typical pulsion diverticulum, the size of a hen's egg, was found above a stricture of the upper part of the Œsophagus, that had narrowed its lumen until it had the diameter of a lead-pencil. The mucous membrane appeared thickened and granular, but showed no scar tissue nor ulceration. The muscular wall of the Œsophagus at the site of the stricture remained unchanged. The normal character of the tissue at the point of stricture would point to a congenital origin. Cases in which a diverticulum was found above a congenital stricture, and which from the description would appear to be similar to Richardson's case, are reported by Cassan²³ and by Bauernfeind.²⁴ In the latter a stricture that admitted a sound only six millimetres in diameter was found at the level of the first tracheal ring. The absence of scar tissue and infiltration proved it to be of other than inflammatory origin. Above this constriction a sharply defined sacculaton, three and one-half centimetres deep,

was found. In Cassan's case difficulty in swallowing dated from early childhood. This, with the absence of cicatricial tissue, proved the stricture to be congenital.

Diverticula situated between the pharyngo-oesophageal junction and the upper border of the sternum are rare, and are probably all of the traction-pulsion group, which have already been considered. Below this, at the level of the left bronchus, there occur occasionally diverticula which are etiologically distinct from the pulsion diverticula of Zenker. These are the epibronchial diverticula of Leutgert. He considers that the anatomical relations of the oesophagus and left bronchus at this point explain their origin, and also determine the frequency of the development of carcinoma in this part of the oesophagus. On examining the oesophagus when removed with the lungs and bronchi intact, Leutgert found that the left bronchus, where it crossed the oesophagus, caused a distinct bulging-in of the anterior oesophageal wall. Above this there is a more or less distinct recess, varying in different specimens from a slight depression to a pocket deep enough to contain the tip of the index-finger. In children this was not found. He believes the obstruction caused by the left bronchus to be sufficient to temporarily arrest the food, which, under certain conditions, such as the presence of an abnormally large bolus, may deepen this epibronchial pocket, and thus cause a diverticulum.

Diverticula of the lower third of the oesophagus are mostly situated just above the diaphragm, and for this reason have been termed epiphrenal. The etiology of this group is not yet clear. Some of them at least are traction-pulsion diverticula, although there are but few glands in close relation to this part of the oesophagus. In the cases reported, the diverticula were mostly found given off from the lateral or anterior wall of the oesophagus, differing in this respect from those higher up. Tetans describes a case in which the fundus of the sac reached to within a few centimetres of the cardia. In the neighborhood of the diverticulum were found pigmented lymph glands, but no cicatricial tissue connecting them with the diverticulum. He regards the diverticulum as belonging to the traction-pulsion

group. A deep-seated diverticulum of the anterior wall of the Œsophagus is described by Oekonomides. At the autopsy of a woman who died at the age of eighty-three, a diverticulum the size of a small apple was found, eight and one-half centimetres above the cardia, anterior and somewhat to the right of the Œsophagus. The sac contained no muscular fibres, and was lined with normal mucous membrane. The absence of fibrous tissue or degenerated glands led to the belief that this was primarily a pressure diverticulum. No explanation of its origin was given.

Besides the traction-pulsion diverticula of the lower part of the Œsophagus, there are a few that are probably due to a constriction of the Œsophagus at a point where it passes through the diaphragm. This constriction may be a cicatricial stenosis of the Œsophagus, or may be due to a congenitally narrow opening in the diaphragm.

The appearance of a typical pressure diverticulum, as found at the pharyngo-Œsophageal junction, is that of a sharply defined protrusion of a portion of the wall of the Œsophagus. The size varies from a pea to that of a pear. They are pear-shaped or cylindrical, with an orifice considerably smaller than the circumference of the sac. The larger ones have a thick wall resembling on superficial examination the wall of the Œsophagus. In the smaller ones the structure is that of a thin translucent pouch. In none of the typical pulsion diverticula do we find a complete muscular layer. The sac, even in the largest, is made up of mucous membrane covered by a layer of connective tissue. Near the neck of the sac there are found muscular bands which have been drawn down from the lower fibres of the inferior constrictor. Diverticula of the lower end of the Œsophagus do not contain any muscular tissue. Those of the pharynx and the traction-pulsion diverticula may have a complete muscular layer. The mucous membrane rarely ulcerates, but frequently is thickened from papillary hypertrophy of submucosæ. Long-continued mechanical and chemical irritation, resulting from the retained ingesta, is sufficient to cause primary carcinoma of the diverticular wall. Cases in which carci-

noma was found are reported by Riebold, Quinset, and Grashius.

The symptoms occasioned by diverticula of the œsophagus are generally identical in the beginning with those of a gradually increasing stenosis which, at times, extends over a number of years. Most of those described have been in persons of advanced years, generally over fifty. In those in whom the dysphagia dated from early life, congenital stenosis probably occasioned the first symptom, to which later were superadded those of diverticulum. In Rokitansky's²⁵ case, in which the symptoms lasted for forty-nine years, the early difficulty in swallowing was probably due to an obstruction caused by the pressure exerted by a goitre. In the development of the diverticulum, as soon as the bulging mucous membrane is enlarged, so that a distinct sac is formed, the ingesta entering with each act of swallowing will be longer and longer detained, since the sac, being formed of mucous membrane alone, has no power of emptying itself, and will gradually enlarge from the pressure from within. The symptoms at first are usually only those of a slight stenosis. The more severe and characteristic symptoms begin when the sac is of sufficient size when full to compress the œsophagus and occlude its lumen, or by its weight to change the direction of the axis of the œsophagus, so that the orifice of the diverticulum is in direct line with the axis of the pharynx. The diverticulum now becomes filled at the beginning of a meal and compresses the œsophagus, preventing any food entering the stomach. Anything taken after this lodges in the pharynx and is soon thrown out again. In some cases, in the early stage of development, if the sac becomes filled, the food subsequently taken passes into the stomach unhindered. That contained in the sac is later ejected, establishing a condition simulating rumination. This symptom is quite characteristic of a diverticulum, although it also occurs in diffuse dilatation of the œsophagus.

In a case reported by Neukirch,²⁶ the patient was able to take food only when in the reclining position. In other cases the food lodged in the sac may remain many hours or days,

and can only be removed by pressure upon the neck or by contraction of the muscles of the neck, or by the act of vomiting. In case of deep-seated diverticula, food taken several days previously may be ejected from the sac, while that taken in the interval is not returned. The food which is ejected from the diverticulum is mixed with mucus and softened, but is never digested, nor does it contain any of the juices of the stomach.

In diverticula of the upper end of the œsophagus the sac, which nearly constantly contains mucus and food débris, empties itself partially or wholly when the patient assumes the reclining position. The semifluid contents escape into the air-passages and bring on severe attacks of coughing or dyspnœa. A patient suffering from a diverticulum in this part of the œsophagus soon learns that in order to secure rest he must empty the sac before going to bed.

Pain after eating is usually a symptom if the diverticulum is of sufficient size to cause obstruction by pressure. This pain usually continues until the sac is empty. It is deep-seated and retrosternal. In a case of diverticulum of the lower end of the œsophagus reported by Jung,²⁷ the patient suffered from violent colicky pains in the epigastrium immediately after taking food of any kind. These pains were at first relieved by vomiting, but later were not. Pain of this character is more significant of spasm of the cardia than of a diverticulum. It must, however, be borne in mind that some deep-seated diverticula are associated with dilatation of the œsophagus and spasm of the cardia. This second case reported by Jung, in which a violent cramp-like pain was also a prominent symptom, would appear to be of this nature. In diverticulum of the cervical portion of the œsophagus a diffuse or circumscribed tumor of the neck, perceptible by inspection or palpation, may be an objective sign that permits of a positive diagnosis. Pressure upon this tumor will force food from the sac into the mouth and will cause the tumor to disappear. In cases where no tumor is recognized, pressure upon the neck behind the sternomastoid may empty the diverticulum and force its contents into the mouth.

The diagnosis of diverticulum of the œsophagus is based mostly upon the clinical history, the subjective symptoms above mentioned, and upon the evidence obtained by the use of the sound. The skiagraph may be employed with positive results in a few cases by filling the sac with bismuth mixture, or by introducing a metallic sound or rubber tube filled with shot. By this means the depth and position of the sac may be ascertained, which is of importance in deciding upon the advisability of an operation. In a diverticulum high up in the œsophagus, and in diverticula of the pharynx, the use of the œsophagoscope gives positive findings. In the deep-seated diverticula its value in making a diagnosis is slight. Transillumination has also been employed, but with limited success. In the sound we have a means of examination, if properly employed, that will permit of a nearly certain diagnosis. In many cases upon attempting to pass a moderate-sized or small sound we find it meets with an obstruction which first appears to occlude completely the œsophagus. Often in changing the position of the patient, as by throwing the head far back or to one side, the obstruction is easily overcome, and the sound passes into the stomach unhindered. In other cases, as in ours, we may not be able to pass a small or moderate-sized sound, while a large-sized sound will easily slip through. In still another class of cases, at certain times all sizes may be passed with ease, while at other times neither large nor small sounds can be introduced.

Rumpel²⁸ has made use of two stomach-tubes to differentiate between diverticulum and dilatation. This method, as improved by Jung, offers the best means, when carefully employed, of recognizing diverticula, particularly those of the lower end of the œsophagus. Rumpel employed two tubes,—one, with numerous perforations in its lower end, is passed directly into the stomach; the other, with but a single opening at the end, into the œsophagus above the cardia. Water, if poured through the second tube, will run down into the stomach through the opening in the first in case of dilatation. If a diverticulum exists, it will first be filled; and if the overflow will reach the stomach, the contents of the diverticulum can be returned to the second tube and measured.

The chief obstacle to this procedure is the introduction of the first tube into the stomach. In some cases of diverticula this is impossible, and in extreme cases of dilatation it is frequently difficult. Jung employs two tubes in the same manner as Rumpel. In addition, he introduces a third smaller tube, with only two perforations at the end, through the first or stomach-tube. By this means he is able to aspirate the fluid from the stomach, which gives positive information as to the position of the tube. With Rumpel's perforated tubes alone no fluid can be withdrawn from the stomach, thus making it impossible to ascertain definitely if the stomach has been entered. By allowing clear water to pass into the stomach through the first tube and a colored solution through the second, and by having the water returned unmixed with the colored solution from the inner or third tube, a positive diagnosis of diverticulum can be made, and dilatation of the œsophagus with or without cardia spasm can be excluded.

In non-malignant stricture of the œsophagus, if a sound be passed into the strictured zone, no mobility of the sound is possible; while in a diverticulum, if the sound be passed into the sac, although it cannot be pushed farther down, a considerable degree of lateral mobility is possible. This procedure is sufficient to differentiate simple stricture from diverticula.

The treatment of œsophageal diverticula may be either non-operative or operative. Of the latter, we have the palliative and the radical operations. The first case in which systematic efforts were made to cure the patient was treated by Dendy,²⁹ who attempted to obliterate the sac by injecting into it a strong solution of nitrate of silver. This proved disastrous, and has not since been attempted. In the persistent use of the sound- and stomach-tubes, we have the only means of palliative treatment worth considering. This method has, with more or less success, been practised by Berkhan,³⁰ Bruns,³¹ and Schede.³² In Berkhan's case the patient remained comparatively well for nineteen years. Neukirch was able to feed his patient through the stomach-tube by placing him on the right side in a reclining position. After the use of sounds and tube

for some time, the symptoms greatly improved. Waldenberg³³ and Schede employed a faradic current applied to the œsophagus near the orifice of the sac and to the diverticular wall, with improvement in the general condition of the patient and diminution in the size of the sac. In Schede's case the sac shortened three centimetres in four years. Although temporary relief may be had in a few cases by the use of the sound, this method of treatment is not free from danger, and can be employed only in a few cases, because of the difficulty in introducing the sound. The chief danger is perforation, which can readily occur, owing to the extremely thin wall of the sac and to the act of vomiting which the presence of the sound may excite. A fatal perforation from the use of the sound occurred in the practice of Bruns.

The palliative operation of gastrostomy designed to relieve the symptoms, or rather to prevent death from starvation, was first practised in 1877 by Shönborn.³⁴ The same method was employed by Whitehead,³⁵ Koenig,³⁶ and Chavasse.³⁷ This operation is only indicated where there is no possibility of removing the sac, as in deep-seated diverticula, or where the patient's condition is such as to preclude the possibility of a successful radical operation.

The method of treatment of diverticula by excision of the sac was first suggested by Klüge³⁸ in 1864. The first to attempt removal of the sac was Nicoladoni. He did not succeed, but opened the sac and sutured it to the skin. Death from pneumonia followed on the eighth day. Bergmann³⁹ in 1890 performed the first successful excision of the sac. In 1900 Veiel⁴⁰ was able to collect twenty-three cases operated on, including one of his own. Of these five died and eighteen recovered. The causes of death assigned were suppression of urine, diarrhœa, bronchopneumonia, and erosion of the superior thyroid artery. In one case the autopsy did not reveal the cause of death.

The technique of the operation for incision of the sac is, with slight modifications, the one first suggested by Hamburger⁴¹ in 1871, several years before the first operation was

performed. In all of the cases operated on a skin incision was made along the anterior border of the sternomastoid muscle; by dull dissection the oesophagus is reached. No vessels of any importance are encountered excepting the superior thyroid vein. In one case the superior and second inferior thyroid arteries were ligated. The normal thyroid gland can be drawn aside and is not in the way. In a case in which the thyroid was enlarged, Bruns found it necessary to remove the lateral lobe in order to reach the diverticulum. The sac has been removed both by cutting and by thermocautery. The latter method has not given good results. The necrosis following its use prevents speedy union of the cut edges. The most important step in the operation is the closure of the opening in the oesophagus. At the present time nearly all operators advocate the immediate closure of the opening by sutures, although Bergmann believes it scarcely possible to secure primary union.

Various methods of suturing the oesophageal opening have been employed. It would appear that the most satisfactory result would be obtained by first passing around the neck of the sac a purse-string suture. Second, distal to this temporary ligature of the neck of the sac. Third, abscission of the sac beyond the ligature. Fourth, invagination of the stump, and tying the purse-string suture. Fifth, suture of the neck of the sac with catgut, using the Lembert suture. Sixth, closing the defects in the muscular wall of the oesophagus by suture, preferably of silk.

Berger⁴² only partially closed the opening by suture and introduced a stomach-tube. This procedure is not to be considered, as the presence of the tube in the oesophagus induces vomiting and subsequent leakage, with certain infection of the wound. Several operators, among them Richardson, Bruns, and Kocher,⁴³ have succeeded in obtaining primary union of the whole operation wound. In two cases a preliminary gastrotomy has been performed in order to nourish the patient during the course of the healing of the wound. Girard,⁴⁴ in 1895, devised an operation for the radical cure of diverticulum of the oesophagus by invaginating the sac into the oesophagus and

closing the defect in the muscular wall of the œsophagus by suturing. He operated on two patients by this method. In one the result was ideal; in the other a fistula followed, which later closed. By this method the œsophagus is not opened, and therefore the risk of infection is but slight. It can only be employed when the sac is of small size, and when the lumen of the œsophagus below the neck of the diverticulum is of normal size.

The following case was referred to me by Dr. J. E. Best, of Arlington Heights, Illinois, and treated by this method.

Mr. W., aged seventy-six years. Present trouble began seventeen years ago, with difficulty in swallowing solid food. For a number of years this was the only trouble experienced, excepting that sometimes after meals food swallowed during the first part of the meal would be returned to the mouth and again swallowed. He also noted that the first food taken appeared to lodge in the upper part of the throat, at a point apparently just below the larynx. As the years passed the symptoms of obstruction became more pronounced, so that about two years ago it became impossible for him to take solid food of any kind. Since that he has been forced to subsist upon liquids, which have been taken with increasing difficulty up to the present time. A few months ago he noted that liquids taken while in the reclining position seemed to be swallowed with less difficulty and to remain in the stomach. At the present time, anything taken while in the upright position is immediately regurgitated. During the last few months he has rapidly lost flesh and strength, and employs most of his time in endeavoring to swallow sufficient liquid nourishment to maintain life. This is accomplished by taking a few drops at a time. After taking food, there is considerable pain, which is referred to the neck above the upper border of the sternum. This pain is relieved by vomiting or by compression of the sides of the neck with the hands, which forces the food previously taken into the mouth. At no time has any blood been vomited.

Examination.—There is a considerable degree of emaciation; chest and abdomen negative. No enlargement of cervical glands. No tumor can be seen or palpated in the neck. On giving water to drink, a small quantity, about thirty cubic centi-

metres, is retained. Any taken after this is regurgitated. Pressure upon the neck made below the larynx and behind the sternomastoid muscles will force the water previously taken back into the mouth. At times, without drinking water, a quantity of mucus can be forcibly thrown into the mouth by pressure made in the same way. If the mouth is opened and sudden pressure made, as described, the mucus or water may be forced from the mouth.

On attempting to pass a small-sized (1.25 centimetres) olive-tipped bougie, there is an obstruction met just behind the larynx at a distance of seventeen and three-quarters centimetres from the incisor teeth. Below this point the bougie cannot be passed, but it can be moved from side to side for some distance. At the time of the first examination, no bougie could be made to pass this point. At a later examination a larger-sized tip (two and one-half centimetres) was employed, and this passed readily down into the œsophagus. At times this large-sized bougie could be introduced without any difficulty; at other times it could not be made to enter farther than a distance of seventeen and three-quarters centimetres. At no time could the ordinary stomach-tube be made to pass into the stomach.

The patient was given a bismuth mixture to drink, and a radiograph of the neck was taken. A fairly distinct shadow was to be seen just in front of the vertebra, and about halfway between the larynx, which was ossified, and the upper border of the sternum. Upon the history and the findings described, a diagnosis of a pulsion diverticulum at the pharyngo-œsophageal junction was made. On January 8, 1903, under chloroform anaesthesia, the patient was operated upon at the Chicago Polyclinic Hospital, Dr. Paul O. Owsley assisting.

An incision was made on the left side from the angle of the jaw to the sternoclavicular articulation anterior to the sternomastoid muscle. The superior thyroid veins and artery were divided between ligatures. Dull dissection through a perfectly dry field readily exposed the œsophagus. There was some difficulty experienced in locating the diverticulum. This was overcome by passing a bougie through the mouth into the pouch. By this means the diverticulum was lifted from its bed and brought to the side of the œsophagus. The diverticulum was pear-shaped and measured four centimetres in length and three

in width. It lay slightly to the left and behind the œsophagus. The neck of the sac was a trifle below the lower border of the cricoid cartilage. The sac was very thin and translucent. With the bougie in the œsophagus the mechanism of the obstruction caused by the diverticulum could be demonstrated. The lower border of the neck of the diverticulum acted as a valve, projecting into the lumen of the œsophagus. Upon introduction of the sound, it came in contact with this valve-like projection, which, upon further pressure, was forced down and completely obstructed the œsophagus, and directed the sound into the diverticulum.

The sac was readily freed from its attachments to the surrounding tissue. A purse-string suture of catgut was passed around the neck with the sound in the sac. The sound was then withdrawn and the sac inverted, and at the same time invaginated into the lumen of the œsophagus. The purse-string suture was then tied. Three sutures of catgut were then passed through the neck of the inverted sac. These did not penetrate into the lumen of the diverticulum. Over these sutures, the longitudinal muscular layer of the œsophagus was united by interrupted catgut sutures. A third layer of chromicized catgut sutures transverse to these was introduced. By the latter the inferior constrictor of the pharynx was brought down, covering the first sutures. A large-sized bougie could be passed without difficulty into the stomach.

The skin wound was closed without drainage. For five days the patient was nourished by nutritive enemata. After this he was allowed milk, which he swallowed without difficulty. At the end of two weeks he left the hospital. Upon reaching home he ate heartily of solid food. Following this he suffered from a severe attack of acute gastritis, for which he was treated by Dr. Best, and from which he recovered. Since the operation he has not experienced any difficulty in swallowing any kind of food.

BIBLIOGRAPHY.

- ¹ Mondiere. *Arch. Gén. de Méd.*, 1833.
- ² Zenker. *Ziemssen's Encyclop. of Med.*, 1878, vol. viii.
- ³ Oekonomides. *Inaug. Dissert.*, Basle, 1882.
- ⁴ Starck. *Inaug. Dissert.*, Leipzig, 1900.
- ⁵ Rosenthal. *Pulsionsdivertikel des Schlundes*, 1902.

- ⁶ Chiari. Prag. med. Woch., 1884.
- ⁷ Riebold. Virch. Arch., Band clxxiii, Heft 3.
- ⁸ Coester. Cited by Zenker.
- ⁹ Tetans. Inaug. Dissert., Kiel, 1888.
- ¹⁰ Tiedemann. Cited by Rosenthal.
- ¹¹ Scherpenburg. Inaug. Dissert., Erlangen, 1893.
- ¹² Leutgert. Pulsionsdivertikel oberhalb des linken Bronchus. Inaug. Dissert., Erlangen, 1892.
- ¹³ Heusenger. Virch. Arch., Band xxix.
- ¹⁴ Bartelt. Ueber Pulsionsdivertikel des Oesophagus. Inaug. Dissert., Erlangen, 1898.
- ¹⁵ Klose and Paul. Cited by Zenker and Rosenthal.
- ¹⁶ Wheeler. Dublin Journ. Med. and Surg., vol. lxxxi.
- ¹⁷ Hackermann. Beiträge zur lehre von der Entsehung der Divertikel des Oesophagus. Göttingen, 1891.
- ¹⁸ Freiberg. Cited by Zenker.
- ¹⁹ Schlesinger. Wien. klin. Woch., April 30, 1903.
- ²⁰ Nicoladoni. Wien. med. Woch., 1877, Nr. 25.
- ²¹ Braun. Deut. Zeit. für Chir., Band lxi.
- ²² Richardson. ANNALS OF SURGERY, vol. xxxi.
- ²³ Cassan. Cited by Rosenthal.
- ²⁴ Bauernfeind. Inaug. Dissert., München, 1893.
- ²⁵ Rokitsansky. Lehrb. d. Path. Anat., 1861.
- ²⁶ Neukirch. Deut. Arch. für klin. Med., Band xxxvi.
- ²⁷ Jung. Am. Journ. Med. Sci., 1900, vol. cxix.
- ²⁸ Rumpel. Cited by Jung.
- ²⁹ Dendy. London Lancet, 1848.
- ³⁰ Berkhans. Mittheil. aus den Grenzgb. d. Med. und Chir., Band i, 1896. Berlin. klin. Woch., 1889.
- ³¹ Bruns. Cited by Veiel; Beit. zur klin. Chir., Band xxvii.
- ³² Schede. Deut. med. Woch., 1896.
- ³³ Waldenberg. Berlin. klin. Woch., 1870.
- ³⁴ Schönborn. Arch. für klin. Chir., Band xxii.
- ³⁵ Whitehead. London Lancet, 1891.
- ³⁶ Koenig. Deut. Chir. Lief., 35. Berlin. klin. Woch., 1894.
- ³⁷ Chavasse. Trans. Path. Soc., London, 1891.
- ³⁸ Klüge. Cited by Girard from Gunther's Lehre von den blutigen operationen. Leipzig, 1864.
- ³⁹ Bergmann. Arch. für klin. Chir., Band xliii, 1892.
- ⁴⁰ Veiel. Beit. zur klin. Chir., Band xxvii, 1900.
- ⁴¹ Hamburger. Cited by Veiel.
- ⁴² Berger. Cited by Girard.
- ⁴³ Kocher. Correspbl. für Schweizer-Aertze, 1892.
- ⁴⁴ Girard. Cong. Français, 1896.

ON BRONCHOSCOPY.¹

WITH REPORT OF A CASE IN WHICH A FOREIGN BODY WAS REMOVED FROM
THE RIGHT LOWER LOBE OF A LUNG THROUGH A BRONCHOSCOPE.

BY ARNOLD SCHWYZER, M.D.,
OF ST. PAUL, MINNESOTA.

THE direct examination of the larynx and trachea are rather rarely used and recent methods. Bronchoscopy is the most recent addition to this kind of direct inspection, and it appears to be very little known as yet. For information and instruction in using the instruments, I am indebted to the courtesy of Dr. Wild, of Zürich, Switzerland, who was formerly an assistant of Professor Killian. These methods are probably generally considered as belonging to the practice of specialists. I do not, however, think that, for instance, inferior bronchoscopy ought to be necessarily considered as such. Bronchoscopy is an outgrowth from œsophagoscopy, which was first executed by Kussmaul, and of late more brought *en vogue* by Mikulicz and others. Kirstein first showed direct laryngoscopy, from which originated direct tracheoscopy. The farthest step was finally taken by Killian, of Freiburg in Germany, with his bronchoscopy. With straight tubes of different calibers and lengths he showed that the air-passages could be explored far beyond the bifurcation of the trachea. He advises the use of the little electric head-light of Kirstein with an attached reflecting mirror, through the centre of which the surgeon looks. Especially where demonstration is desired, an electric light fixed to the bronchoscopic tube (Kasper's handle) is very useful. This special apparatus is not absolutely necessary, since, in the case which I am about to report, I had to make the greater part of the examination with a common search-light and a common head-mirror. While it was not as convenient, the light was

¹ Read before the Minnesota Academy of Medicine, December 2, 1903.

good and sufficient. The bronchoscopic tubes are connected with a solid handle, with which we can use quite a little force in directing the bronchoscope into the desired direction. Some guide tubes, in case we want to change the tube for a longer or shorter one of the same caliber, are added. Sponge-holders, a fine suction tube, some hooks, and several kinds of forceps constitute the armamentarium. The instruments are as well adapted for œsophagoscopy. The examination can be done either directly through the mouth and larynx (the tubes being up to fifty centimetres long) or through a tracheotomy wound (inferior bronchoscopy). The head has to be thrown far backward, so as to allow of introduction parallel to the axis of the body.

The history of the case, which was kindly referred to me by Dr. William Richeson, of St. Paul, is in brief as follows: Five weeks ago a woman, forty-eight years of age, during a coughing spell, while eating soup, felt a bit of bone get into the windpipe. There has been coughing ever since and expectoration. The temperature, which had been taken the three days previous to my first visit (October 22, 1903), was slightly subfebrile, reaching 100.2° F. As I was going out of town for three days, I advised for the start inhalations with Tinct. benzoin comp., 50.0; creosote and turpentine aa 25.0. These inhalations, as recommended a few years ago in the Johns Hopkins Hospital bulletins, I use prophylactically and therapeutically in all kinds of surgical proceedings in the air-passages, and they have given me very great satisfaction.

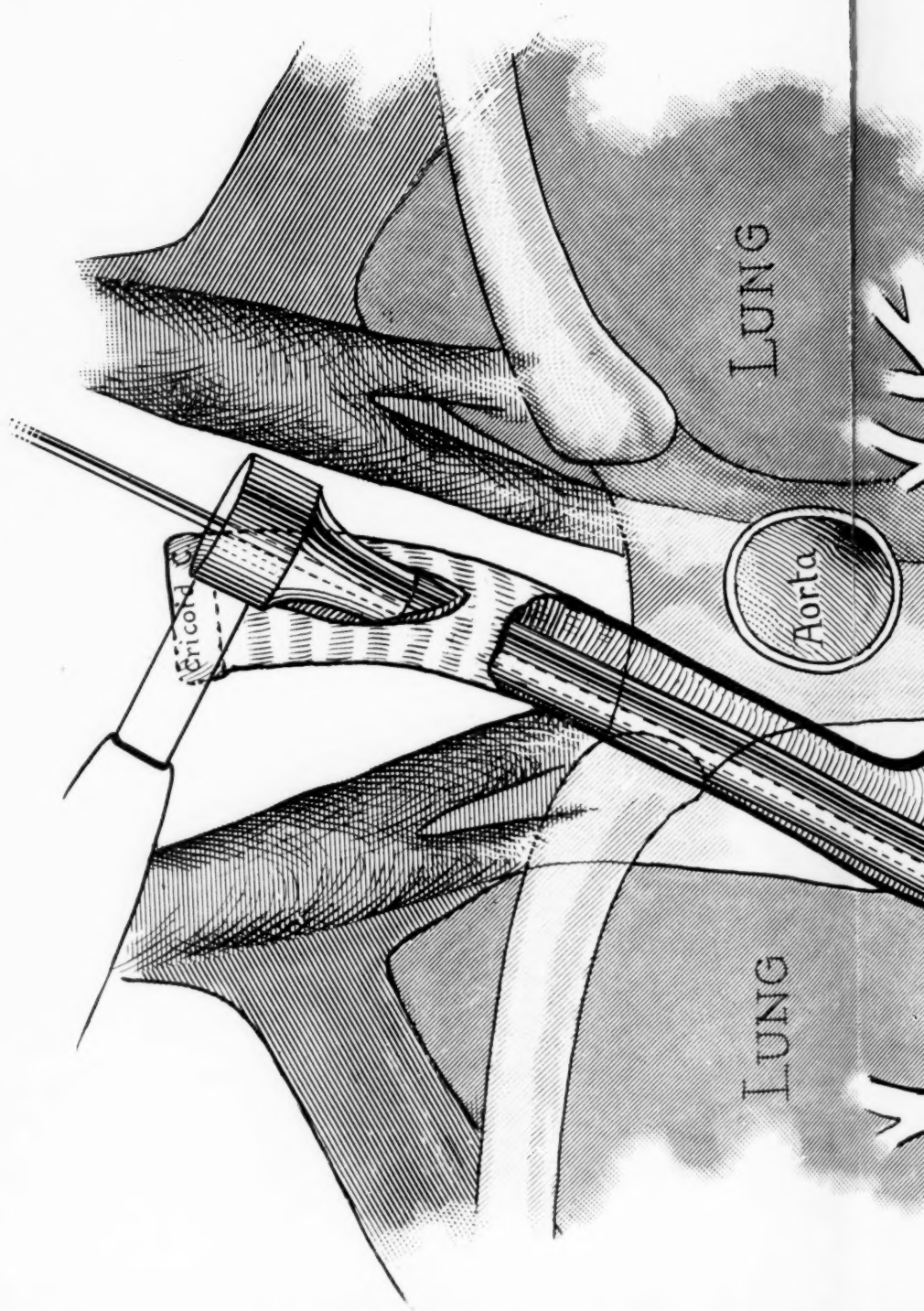
On October 26 I ordered the patient to the hospital for surgical measures for the following reasons: First. There had been some fever, now 99 $\frac{4}{5}$ ° F. Second. Severe coughing spells were frequent. Third. Such a case is always to be considered as a grave one on account of the secondary complications.

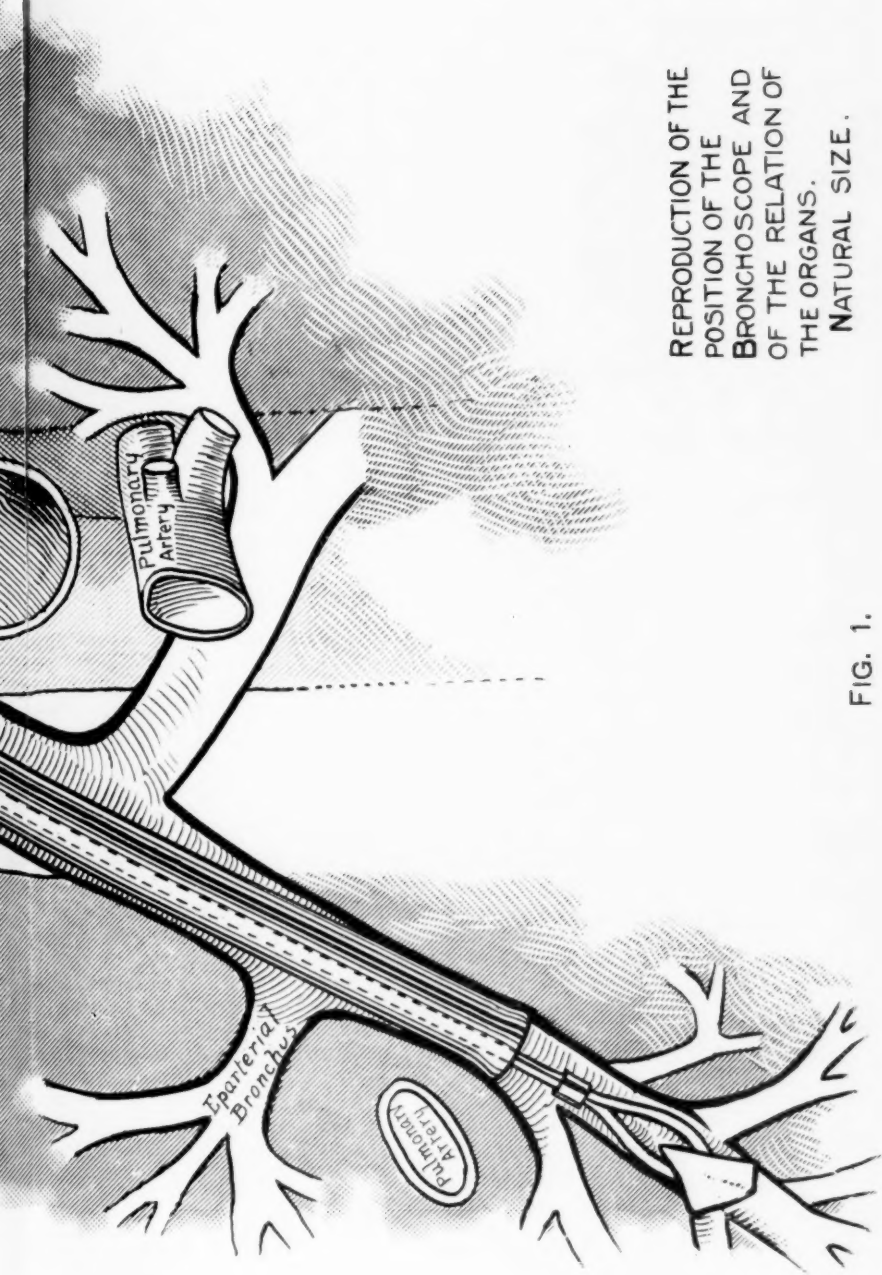
On the day of admission, an attempt was made to make a bronchoscopic examination through mouth and larynx after the application of 20 per cent. cocaine in 1 to 10,000 adrenalin. On two trials to insert the tube through the larynx alarming choking spells occurred, which continued for a little while even after the removal of the tube. A large goitre which she had was judged to

be partly the cause of the difficulty. The goitre presented two large lateral lobes of medium consistency, which joined over the trachea. It is just such lateral lobes which are prone to produce tracheostenosis, by side pressure on the tracheal cartilage rings, which are open behind.

A strumectomy was decided upon as a preliminary operation. This was done on October 27. A horizontal incision was made and the median portions of the two lobes were removed. There were numerous ligatures needed, but the loss of blood was very slight. Finally, the trachea was laid bare for a distance of about four centimetres. The wound was closed to a small central opening, through which an iodoform gauze strip was introduced and laid over the trachea, so as to have it handy for further measures. The wound healed very nicely up to the drainage opening. The drainage was removed after four days, and the patient was allowed to leave the hospital on November 2, six days after the operation. It was judged better to postpone the opening of the trachea until November 10 (two weeks after the strumectomy).

November 10, in the presence of Drs. G. Schwyzer, E. F. Geer, A. R. Hall, and Moynihan, the granulating wound was somewhat enlarged in the old scar line, and some granulation tissue was removed until the trachea was felt plainly under the finger and probe. The trachea was then opened by an incision, the lower end of which was about three centimetres above the manubrium sterni. This opening of the trachea was made at least two centimetres long, so as to allow the insertion of the bronchoscope without difficulty and without marked kinking of the trachea. All this was done without even local anæsthesia; but as severe coughing started when the trachea was cut into, we at once anæsthetized it with the above-mentioned cocaine adrenalin solution, the utmost care being exercised to prevent cocaine poisoning. There was not more than a small quantity at hand, and only a part of it was used. There were no signs of any general effect at any time. I judged the adrenalin would be useful, first, since by the extreme contraction of the blood-vessels caused by it the mucosa would be less voluminous; second, the hæmorrhage which would come from the injury of pushing the bronchoscopic tube up and down in the different parts of the lungs would be much reduced, and therefore much sponging would be saved and also much coughing; third, since the combination of the





REPRODUCTION OF THE
POSITION OF THE
BRONCHOSCOPE AND
OF THE RELATION OF
THE ORGANS.
NATURAL SIZE.

FIG. 1.

adrenalin would prolong the action of the cocaine and cause it to be less rapidly absorbed. This would reduce the toxic effect, which is an important factor when the whole tracheo-bronchial system has to be explored. It may be mentioned that we did not use cocaine away down in the bronchi except when a coughing spell began to hinder the manipulations.

The patient was removed into a dark room and was examined in a horizontal position, the head thrown far back by a round pillow under the shoulders. The exploration of the bronchi was done only with the help of the mentioned local anæsthetic; and it was very fortunate that a general narcosis was not necessary, because the whole performance took from 9.40 to 11.55 A.M. (A part of this time was lost in often allowing the patient to rest, though usually with the tube in the bronchus.) The tube employed measured fifteen centimetres up to the thicker region of the handle. Its lumen had the caliber of a bougie No. 24. The tube was inserted down into the trachea and the bifurcation was made visible. The two principal bronchi were seen and found free. I entered the right bronchus, but could not see things plainly. Then I went back into the left bronchus. At its entrance the mucosa was somewhat hæmorrhagic, apparently slightly injured by the tube. I found the left bronchus in all its length free, and showing besides a pale color some anthracotic discoloration in small areas. The secondary bronchi were plainly seen as dividing off, but no trace of a foreign body or any suspicious change in the appearance of the bronchi could be detected.

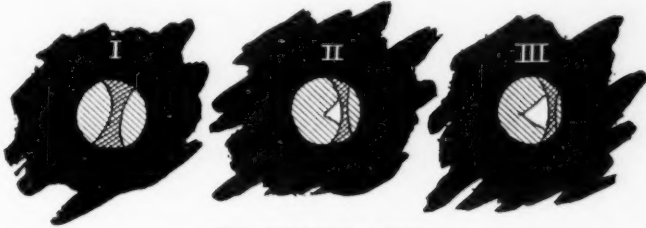
There was much lively and even violent pulsation going on around the bronchi. This everlasting motion and activity in the chest was very impressive, and made us use the utmost care in handling the instruments. The arch of the aorta rides on the left bronchus, and the pulmonary arteries are in even closer proximity to the bronchi. These large vessels, practically at their origin from the pumping heart, explain this fact sufficiently. The motion is most pronounced on the left bronchus, and was no longer noticed when we had entered far down in the right bronchial tree. The more we reach the periphery with our bronchoscope, the more, however, comes respiratory motion into play. The breathing was not giving any difficulty. From my drawing (Fig. 1), in which I gave as nearly as possible the natural size of the bronchi, one can see that there was room for breathing on

the sides of the bronchoscope. There was, of course, lively breathing going on through the tube. Killian has shown that, when the one bronchus is entirely put out of function on account of the tube, the respiration does not become dyspnoëic. The exchange of air goes on sufficiently through the bronchoscope and the one lung under exploration.

I had satisfied myself that the foreign body (if there really was one in the lungs) was not in the left bronchi of first and (most probably) second order. By this time I had exchanged the special electric-light apparatus (the Casper handle with its light and the little Kirstein head-light) for a common laryngoscopic head-mirror with a strong electric search-light at some distance in front of me. This had become necessary on account of some trouble with the battery. The light was now brighter, but the search through the long tube was exasperating at times on account of slime and blood and coughing spells. I then began the thorough search of the right lung. The main bronchus was free but reddened, and contained much mucopurulent secretion. This change was already an important guide. The bronchus was followed to the origin of the secondary bronchi. After much searching and sponging and following the right bronchus to its end as far as the tube would reach, I thought I saw in the depth a small whitish spot. After repeated trials, I recognized it as a foreign body, and thought it to be the sharp point of a *bone*. The tube had been entered six inches (fifteen centimetres) from the tracheal opening downward. The tracheal opening was three centimetres above the incisura sterni. When the tube was allowed to lie as it would naturally, merely two bronchial openings were seen (Fig. 2, I). When it was tilted with its lower end to the right in a moderate way, Fig. II was seen. In the picture it may appear that the tube was now more to the left than in Fig. I. It must, however, be taken into consideration that the bronchi are not solidly fixed in their course and position. In reality, the lower end of the bronchoscope was more to the right, as I had inserted the tube somewhat deeper, and felt it enter more towards the left one of these two bronchial branches, which had a straighter course downward. Then, when I had caught part of this bifurcation with the lower end of the bronchoscope, I pressed to the right so as to see straighter down into this lower bronchial branch. Now, the little triangular white body could be seen at some distance in this lower branch. When

a maximum of force was used in pressing the lower end of the bronchoscope to the right, this white triangle became as large as Fig. III shows.

FIG. 2.



The bronchoscopic images.

I may add here, that it is surprising how one can move the exploring tube into the different bronchi. They give way to pressure, and take a straight course over the inserted instrument because they are in the loose, soft lung tissue, which is ready to yield. When we reach a division of a bronchus, tilting of the bronchoscope will allow us the entrance into the desired side; and as soon as we have entered the channel, the tube may be pushed forward, if it is done under constant control of the eye. The drawing shows how even the trachea in our case had to be moved far to the right. On one occasion I managed to introduce a small hook beyond the bone. When I, however, pulled at it, it seemed caught, and the mucosa appeared to lay itself in folds in front of the bone, which pushed it forward from behind. I did not dare to pull too hard, because I was afraid of forcing the sharp-edged bone into a more firmly fixed crosswise position; and when I could not free it with a reasonable amount of traction, I was glad when I had the little hook free again. It was not until some time after I had seen the white body that I finally succeeded in grasping it safely with a forceps. The bone was too large to be brought through the small bronchoscope, therefore I withdrew the tube together with the forceps, and fortunately the bone in its grasp. A small strip of mucosa came along also; however, there was no marked bleeding.

The bronchoscope had not reached the immediate neighborhood of the bone. The latter was about three centimetres beyond the tube. This was part of the difficulty. The accompanying photograph (Fig. 3) gives the exact position of the instrument

when inserted down to the foreign body. The bone was therefore removed from a point eighteen centimetres below the tracheal opening, or fifteen centimetres below the upper border of the manubrium sterni. The measurements were taken immediately after the extraction of the bone, and they were controlled by Drs. Hall and Moynihan.

It may be mentioned that the patient, who received once during the operation a hypodermic of strychnine, stood well the tedious performance, and, though she complained now and then (when asked) of being tired, claimed even towards the end to feel "good." There were at no time severe pains; but now and then a harder coughing spell was produced, when a new area of the lungs was entered into, which had not yet been sufficiently cocaineized.

It is interesting to note how the pains of the patient, who located the trouble to the left of the heart apex region, were misleading. The patient distinctly claimed that the trouble was located on the left side. I had, however, told her and the doctors present that I considered the foreign body to be on the right side, having heard moist râles of medium size over the right lower outer anterior region, and there only. This corresponded with the location of the bone. The piece being somewhat like a sharp-edged triangular pyramid explains the fact that breathing was not abolished over this lung area. The air found some opening on the sides of the bone. I had made no note about reduction in the breathing sounds.

It may be objected that we undertook all these manœuvres and even the goitre operation though we had no absolutely sure proof that there was a foreign body present, and that we did this notwithstanding the patient had somewhat improved after the goitre operation. There had, however, occurred a severe coughing spell the evening before the bronchoscopic search; and it is just this more or less constant coughing, if it first started after a mishap in the deglutition, which is significant, especially when combined with now and then very severe coughing spells, though an adequate reason for it does not otherwise exist. Principally on this symptom I based the positive diagnosis. The patient had been well up to the point when she got something into the "wrong pipe." It happens comparatively so often while eating soup, because small pieces of bone are often there unexpectedly, and a

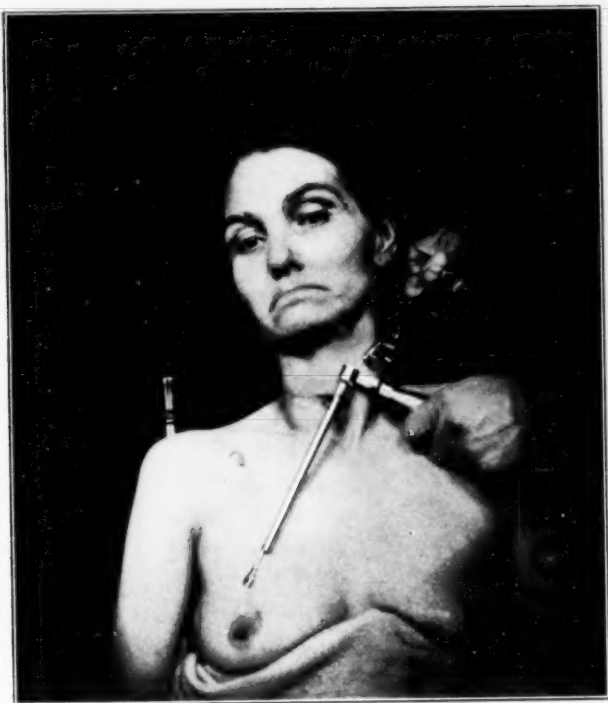


FIG. 3.—Photograph made eight days after removal of the foreign body, showing the direction and extent of insertion of the bronchoscope, and the forceps.

motion of inspiration is made when eating this liquid from the spoon. The history was typical in our case. Fever had set in. The case ought to have been skiagraphed before the operation, but this had to be omitted for other reasons.

The after-history is very simple. The wound was covered with gauze. Every two hours the patient received the same inhalations as before the operation.

On the afternoon of the day of the operation the patient coughed considerably and had a bloody sputum. The temperature, however, remained below 100° F., and on the following days at the highest reached 99° F.

On the day after the operation there were no râles to be heard over any part of the lungs, except at voluntary coughing, transmitted from the trachea. On the next day (November 12) the patient claimed to feel much better than before the last operation. Very little coughing; much less than before the bone was removed. Patient felt quite strong; sat up in a chair. No air passing through the tracheal incision.

On November 13, three days after the operation, the patient left the hospital. On November 18 patient came to my office, where the adjoined photographic picture (Fig. 3) was taken. Condition very good.

Of the literature pertaining to foreign bodies impacted in the air-passages, I should like to first mention the standard work of Hoffmann, in Nothnagel's "*Specielle Pathologie und Therapie*," 1897. In this treatise Hoffmann gathers 160 cases (operated and not operated), only taking into consideration the sufficiently clearly described ones. In forty-five of the cases operative measures were used, principally tracheotomy; in single cases, however, opening of a bronchiectasis or opening of an abscess cavity. Hoffmann classifies the foreign bodies in the following way:

First. Bodies apt to be coughed out on account of their weight and smooth surfaces (pieces of money, glass pearls, etc.), ten cases, with nine cures, of which six had a tracheotomy. In three cases the favorable result was not dependent on the tracheotomy.

The second group consists of hard and irregular pointed

bodies (pins and pieces of bone), which could not be expected to be coughed out. Of these he gathered fifty-one cases, among which are thirty-eight non-surgical cases with twenty-one deaths to seventeen cures, while among the thirteen operated cases there were only three deaths.

A third separate group contains ears of grain. These give very poor chances for a spontaneous expectoration. In none of the sixteen cases was the foreign body coughed out soon after its entrance. In four cases it was expectorated after a long interval (fifty days to many years); four others of the sixteen died, and eight were cured after formation of abscesses, which perforated through the chest wall.

Another, fourth, group contains the fruit kernels. Of these were, non-surgical, twenty-four cases with eight cures and sixteen deaths. Operated, thirteen cases with seven cures and six deaths. Considering separately kernels apt to swell hygroscopically, Hoffmann finds non-surgical, seventeen cases, with five cures and twelve deaths; operated ones, eleven cases, of which only three died.

A fifth group contains all the other cases of very different kinds. Hoffmann declares that surgical procedure is for the large majority of the cases the proper one, but he condemns working with hard instruments without the control of the eye. Hofmeister ("Handbuch der practischen Chirurgie," Bergmann, Bruns, and Mikulicz) also highly recommends an active but careful surgical procedure, and especially if the case is a recent one, where other simpler methods have not yielded a result. Only in a case of a foreign body of small size, which entered far down into the bronchi, where it cannot be reached from above, may an expectant treatment be allowed.

Kredel (*Mittheilgn. aus d. Grenzgeb. der Med. und Chir.*, 1903, Band xi, Heft 1) reports some interesting cases, and emphasizes careful surgical measures in cases of impaction in the bronchi, even if the foreign body cannot be seen, as in small children. A flexible wire loop gave him good service.

Kredel, the latest one of these mentioned writers, thinks it doubtful that the extraction under the guidance of the mirror

should be easier; the technique, of course, being more complicated, if simultaneously a mirror and the instrument for extraction have to be handled. He appears not to have personally used Killian's instruments. He says that, as much as the results of the bronchoscopy are praiseworthy, it will hardly become popular, because there is too much special training needed and too many special instruments, etc. Furthermore, he thinks that it is doubtful whether bronchoscopic measures are less dangerous (with or without tracheotomy) than the other procedures thus far resorted to. I must somewhat differ with Kredel in these latter points. First of all as to the special training needed. While such operative measures are not within the reach of every general practitioner, a surgeon, who can do a satisfactory cystoscopic examination in male patients or even only in women, is in my estimation entitled to handle Killian's tubes for the inferior bronchoscopy. The superior methods, that is the use of straight tubes *per vias naturales* into larynx and trachea, are hard ordeals for the patients in most cases. The inferior bronchoscopy is, however, not as heroic a measure as it might appear.

What concerns the second objection of Kredel, the need of special instruments, I can answer that the special apparatus for illumination may, if necessary, be dispensed with, and there remain only as really needed some straight tubes and sponge-holders. The hooks and forceps are as well needed for extraction with as without bronchoscopy.

That the whole performance is less dangerous, and more satisfactory with the bronchoscope than without, will probably be admitted by every one who has used it once. It is my aim in this report to emphasize the practical value of Killian's thought.

Bronchoscopy, where it is feasible, is certainly a splendid help. And where should it not be feasible, when the trachea is opened? Even in small children it must be possible to a good measure.

Where a foreign body is so far down in the lungs, as it was in our case, I cannot see how any other procedure could be

compared with this method. Where it is possible, bronchoscopic examination ought to precede the removal of foreign bodies from the bronchi, and the manipulations and the extraction ought to be done under the guidance of this instrument, as in such way unnecessary injuries will best be avoided. In the most difficult cases the bronchoscope will be the only means of accomplishing a successful extraction.

Three days after reading this paper, I was called by Dr. Plondke, of St. Paul, to see a girl of four years and seven months who had a kernel of corn in the bronchus for five weeks. The right lung had been giving hardly any breath sounds. At my examination, there was, however, breathing on both sides, and nearly equally loud. Over both lungs there were very numerous râles, most pronounced on the left side. The breathing was characteristic. It was dyspnoëic, interrupted by much difficult coughing. The finger-nails were bluish. There was orthopnoëa; the little child did not dare to lie down for fear of more difficulty in breathing. While the inspiration was comparatively rapid, and, though somewhat difficult, freer than the expiration, the latter was much labored and very often cut short, so that it appeared to me as if closed by a ball-valve. The voice was hoarse, and together with a croupy cough pointed to a difficulty at the glottis. Temperature, 100° F. I diagnosed a foreign body, which had moved from the bronchus into the trachea and was in expiration forming a ball-valve under the glottis.

I operated as soon as the preparations would allow. The child became exceedingly dyspnoëic, and later on in the operation could get no air at all, so that the trachea had to be opened rapidly. Then the picture was at once changed. The air passed much more freely in and out through the tracheal opening, as though a great part of the obstruction had been in the larynx. The larynx was probably somewhat cedematous and much congested. A coughing spell made us notice a yellowish body, which was thrown by the coughing towards the tracheal opening from below. It appeared unexpectedly several times with much mucopurulent secretion. It could, however, not be

caught. We recognized that the body would have come out if the opening had been larger. Though it was of good size, the spreading of the tracheal edges had flattened the opening somewhat. I enlarged it upward and downward, and the next coughing spell made the large, long kernel fly out. Its dimensions were fourteen millimetres by nine millimetres by five millimetres. There is no question but what this kernel had been impacted into the right main bronchus, then began to swell and soften, and then entered the trachea, where it gave a marked dyspnoea for both lungs. As long as we know that a person can breathe freely with only a part of one lung entirely unobstructed, it is not surprising that the difficulty became greater for the child, when the trachea was to a great extent obstructed through this large grain, than when one lung was entirely shut off. The difficulty was even more marked in the forced expiration, when the kernel flew up against the glottis and obstructed this narrow channel like a ball-valve. I do not think that this kernel was thrown against the glottis at every expiration, but only when the child coughed. The difficulty in the inspiration was probably due to a congestion in the glottis, besides a partial obstruction by the kernel at the bifurcation of the trachea. The face of the child appearing congested and somewhat cyanosed, we must conclude that the same congestion due to the dyspnoea was in the glottis. This explains the much freer breathing as soon as the trachea was opened, notwithstanding the kernel of corn was below the opening.

Before cutting the trachea, the difficulty in inspiration was due to two causes,—the one of which was the narrowed glottis, the other the obstructing kernel at the bifurcation of the trachea. The former must have been an important factor, because the breathing and the color of the child changed markedly as soon as the trachea was freely opened. In expiration the large tracheal wound would allow of more air passing by the kernel than the narrow and swollen glottis would.

After the foreign body was removed, the respiration became easy, the cyanosis disappeared, and the breathing

through the larynx became free even when the trachea was allowed to close. The child recovered nicely.

I have been anxious to add this case to my paper, as I find several cases in the literature where the dyspnœa was not enough allowed to command all therapeutic measures. Kredel, for instance, reports a case where a child was erroneously treated for pleurisy, and where suddenly most pronounced expiratory dyspnœa occurred. The inspirations were very short and snappy, while the expirations were labored, long, and whistling. No knowledge existed of a swallowing of a foreign body, and the case remained unoperated. Besides the expiratory dyspnœa, severe acute emphysema of the lungs was observed. The child died within an hour.

Of another case I found a pretty drawing of an autopsy specimen in the "Handbuch der Chirurgie." There you can see a bean impacted in the entrance to the right bronchus. It swelled, protruded gradually more towards the trachea, until finally the other bronchial opening became interfered with. Such cases cannot be too strongly impressed on our mind, and their memory is most useful for other cases of this kind. A detailed observation of the character of the dyspnœa in each case is very important, and the more we have detailed cases of this kind the more will the diagnosis become sharply detailed, and this will be helpful for the steps to be taken in each individual case. All these experiences help to condemn the expectant treatment in doubtful cases, especially since we are better equipped to explore the air-passages.

THE MIXED TUMORS OF THE SALIVARY GLANDS.

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(A Study from the Department of Pathology of Columbia University.)

(CONTINUED FROM PAGE 97.)

SUMMARY OF THE CLINICAL COURSE AND GENERAL MORPHOLOGY OF THE TUMORS.

BEFORE summarizing the details of the results of the study of the cases just given, it may be well to note the relative frequency of occurrence of tumors in the salivary glands. Böhme, in a collection of a large number of tumors from this region, found that they occur in the parotid ten times more frequently than in the submaxillary, while the sublingual gland is the site of tumor formation only in 1 per cent. of the whole number examined. Küttner also gives the proportion as eleven to one. This proportion is not to be observed in my own series, for, taking those in which the source of the tumor is definitely recorded, the parotid growths number twenty-six, while the submaxillary number thirteen, or exactly half as many. That this is probably due to the fact that in preserving these tumors the rarer submaxillary growths were more often saved than the more abundant parotid growths is evident from the Pathological Records of St. Luke's Hospital, where the parotid growths operated upon are five times as numerous as the submaxillary. Of the fifty-nine tumors recorded in this paper only four are from the lip, four from the pharynx or palate, two from the neck, and one from the cheek. Even this cheek tumor was in contact with Steno's duct, and should probably be considered as connected genetically with the parotid.

If we consider the tumors from the point of view of the frequency of the mixed growths as compared to the other neoplasms of the salivary glands, we find that out of the fifty-nine cases one may possibly be considered as an adenoma and two as sarcomata, a third is a fragment of embryonic connective tissue, fat, and blood-vessels, the remainder may be considered as belonging to the mixed tumors or the so-called endotheliomata. The author has in his possession three carcinomata and one pure adenoma, while a pure myxoma, a rhabdomyoma, and a round-cell sarcoma are in the collection of the Pathological Department. Evidently the mixed tumors form a large proportion of the tumors arising in the salivary glands. Cases reported by other observers show the same proportion. Kaufmann in fifteen cases of salivary gland tumors saw one angiosarcoma; Nasse in thirty-six cases saw two carcinomata and two sarcomata; Volkmann in thirty-three cases saw one carcinoma, one myxoma which he is inclined to regard as of endothelial origin, and one fibrosarcoma. Landsteiner, who has already been quoted, saw only two purely epithelial tumors out of twenty-seven examined, the remainder being of the complex variety.

Volkmann also quotes Marchand as saying the greater proportion of the salivary tumors which the latter had seen were to be classed under the general group of endotheliomata, and that purely epithelial growths were of very great rarity. The tumors described by the French observers as adenomata or epitheliomata are usually of the complex type, and very few are either pure sarcomata or carcinomata.

Küttner in ninety-seven submaxillary tumors which he was able to collect from the literature found sixty-four endotheliomata, six sarcomata, three doubtful cases of adenoma, five carcinomata, and nineteen cases in which the description was so imperfect that no determination of the nature of the growth could be made. It is evident, therefore, that the mixed tumors form a very large proportion of the tumors of the salivary glands. As regards the pharynx and lips, it is a matter of common experience that the mixed tumors are exceedingly

rare in these situations, and that the purely epithelial tumors are exceedingly frequent.

General Morphology.—The mixed tumors of the salivary glands are found, as a rule, to be encapsulated, lobular growths, with harder and softer areas, the denser portions being due, as a rule, to the presence of cartilage or firm connective tissue. They can be divided macroscopically into three great rough groups with characteristic morphology, and to a certain extent with a definite clinical course.

First. Very fibrous tumors with very little cellular structure and with but little mucous degeneration and no cartilage.

Second. Very hard tumors containing large masses of cartilage and but little connective tissue or cellular parenchyma.

Third. Soft, very cellular growths with transparent trabeculae of mucous tissue surrounding areas which are opaque and yellow, which on microscopical examination will be found to be dense cellular areas, the color being occasionally, though not always, due to fatty degeneration or necrosis of the cells.

The first and second forms are likely to be benign in their clinical course, while the third form is likely to recur locally or to run an exceedingly malignant course.

A few of the parotid tumors examined and one from the pharynx belong to the first group; about one-fourth of the growths contain more or less cartilage and fall into the second; while the majority of the mixed tumors belong to the third. It must be remembered, however, that a great amount of variation is present in different parts of the same tumor, and while one portion may be cellular the other may be composed largely of cartilage.

The cellular tumors without cartilage, of the third class, have much the same consistency as an inflamed lymph node. The cut section of one of these tumors may show either a large amount of clear hyaline cartilage with a moderate amount of yellowish cellular substance lying between the pale blue translucent nodules of the cartilage, or the whole growth may be cellular and of a pale yellow or grayish hue, or, finally, the cartilage may be scattered throughout the tumor in the form

of small nodules. Some of the tumors resemble very closely soft fibromata, especially if much mucous degeneration is present. If the surface of the more cellular growths is scraped with a knife, a milky fluid can be obtained which is due to the removal of the alveolar cells by the mechanical action of the knife.

The development of these tumors may take place before birth, in which case they are often associated with other congenital defects of the facial region. (Case L.) As a rule, however, the actual development of these growths becomes noticeable most frequently during the second decade of life.

Time of Occurrence.—In my own series the age at the time of the operation was as follows: one tumor under one year, seven between the ages of twenty and thirty, ten between thirty and forty, ten between forty and fifty, ten between fifty and sixty, and four over sixty. If the cases are subdivided according to the decade in which the tumor appeared, the age periods are somewhat different. Four tumors appeared in the first decade, one in the second, thirteen in the third, eight in the fourth, nine in the fifth, four in the sixth, while three still remain in the seventh.

The average age in these cases is then a little higher than that found by Kaufmann and Küttner, according to whom the majority of growths appeared in the second decade. The number of tumors from other regions of the face is too small to furnish useful statistics.

The average duration of these tumors until they cause the patient to seek surgical aid is in my series eight years and nine months, thus varying only slightly from the time given by other observers, eight years. A long clinical course is not uncommon; thus, Case VI gave a history of the presence of a tumor for twenty years, Case IV for fifty-three years. The social status of the patient may also determine a variation in the time which a tumor is allowed to remain, for among the working-classes these tumors often have a longer history than among the wealthy.

Relations of Tumors to Surrounding Structures.—The

anatomical position and the relations of these tumors to the surrounding structures are often characteristic of growths of this type. They are seen in the pharynx attached to the bony structures of the hard palate, often indenting the substance of the bone, but not involving the bone substance. There is usually a thick fibrous capsule which separates the tumor from the periosteum, or the capsule of the tumor may be formed by the periosteum. They also occur on the inner surface of the cheeks, generally near the openings of Steno's duct, and in the substance of the lip, most often near the median line. They also occur in the cervical region in the upper triangle of the neck and in front of the sternocleidomastoid muscle. The most frequent situation, however, is near or in the substance of the parotid and submaxillary glands. Their relations in this case are most variable. The tumors may not be in any way connected with the gland but merely lie near it; they may be attached to the gland by a pedicle or be adherent to a small accessory gland; they may indent the surface of the gland, being separated from the acini by a fibrous-tissue capsule, or, finally, the tumors may be multiple and dot the substance of the gland itself.

Usually in large tumors the remains of the glandular tissue are stretched out over the surface of the tumor and undergo pressure atrophy, but are separated from the tumor substance by a capsule. In the pharynx, the lips, and the cheeks the tumors usually lie just below the surface of the mucous membrane; but the parotid, submaxillary, and cervical new growths are below the deep fascia. They are, however, unless of a large size, easily movable in the tissues. The larger tumors are fixed, not so much by invasion of the structures surrounding them as by the tight stretching of the fascia which they cause during their growth. In those cases in which the tumor becomes malignant, the immobility is due, of course, to the invasion of the surrounding tissues.

The skin is freely movable over the benign growths. The ear may be distorted or pressed entirely backward by a large tumor in the parotid region, especially if the growth has exten-

sions behind the angle of the jaw, and is therefore unable to expand anteriorly.

✓ *Clinical Course.*—Considering the mixed tumors from the face and neck as a group, we may say that an average of the cases in the literature shows that some 25 per cent. undergo changes which express themselves in a clinically malignant course, while about 30 per cent. recur after operative removal, though some of these recurrences may be stayed by a second and more complete removal. The records of my own series are somewhat different. Out of thirty-seven cases in which notes of the patient's condition after operation have been recorded, seventeen, or 45 per cent., recurred locally. In four of the cases either internal metastases were soon apparent or the local condition was so serious that the patients either died of operative shock, as in two cases, or became inoperable from the invasion of the bone and deep tissues of the neck. Of the remaining thirteen cases one is still alive after many operations, but will probably soon succumb to the growth, which is now beyond removal. In twelve cases, then, or nearly 33 per cent., there were local recurrences which were checked by operation, so that a second removal should always be attempted if the anatomical conditions permit of a complete removal of the new growth.

The malignancy of these growths can be judged to a certain extent by their slowness of growth and their physical characters. The hard fibrous and cartilaginous tumors are apt to be benign, while the soft cellular types are likely to prove malignant. But frequently a tumor which has remained for a long time quiescent will begin a most rapid growth (Case XXXVII), and in a few months increase in size more than during its entire previous existence. This sudden and rapid growth is accompanied by the clinical and microscopical evidences of malignancy, and the tumor spreads through the surrounding tissues, involves the skin and the salivary glands, and may form metastases, changes which are illustrated by Cases XXV, XXVIII, and XXXVI. Twenty cases out of thirty-seven, or 55 per cent., were permanently cured by operation.

No sufficient explanation has been adduced for the sudden change which takes place in the benign growths and causes them to become malignant. Kaufmann regards the constant traumatic irritation of the tumor by the muscles of mastication as a possible inciting agent.

It is quite probable that the dense fibrous capsule which surrounds these tumors contributes to their prolonged benign character by preventing the tumor cells from easily spreading through the tissue; for when this capsule is removed by operation on a quiescent tumor and small portions of the tumor cells are left behind in the scar, a rapid recurrence is the rule, and the new growth may reach a bulk in a few weeks greater than that of the original tumor, which may have taken years to develop. The increased vascularity of the tissues may have something to do with this rapidity of growth, for the comparative absence of blood-vessels in the primary mixed tumors is noteworthy. This poor blood supply in the original growths and the lack of close relationship between the cells of the tumors and the vessels may also be contributive to the comparative innocence of the mixed tumors, while in the sarcomata, with their very abundant blood supply and close relationship between cells and vessels, extreme malignancy is the rule. There is still a third element which must be considered as a possible factor in the development of malignancy in these growths, and that is the abundant embryonal connective tissue which is found in many of them. In two of the writer's cases of very malignant growths, the metastasis was purely sarcomatous; there was no alveolar arrangement of the cells and none of the other elements of the original tumor were present. It seems likely that the embryonal connective tissue of the original growth underwent a change which expressed itself in the formation of a rapidly growing sarcomatous tissue, and that the other elements of the tumor took no part in the process. The cartilage of the original tumor does not, as a rule, appear in the recurrences, and the amount of elastic tissue is in general much less than in the primary growth. In those cases in which a recurrence does contain cartilage, as in Case XXVI, the removal

✓ of the primary growth has been very incomplete, so as to leave portions of the original cartilage *in situ*.

✓ 268 In only one of the cases examined by the writer has there been metastatic invasions of the lymph nodes. This case (IV), however, was complicated by what is probably to be classed as an epithelial tumor arising in a mixed growth of the parotid. Both the remains of the mixed tumor structure and the epithelial alveoli are to be found side by side in the same section. None of the other cases of the mixed type of tumor furnished metastases involving the regional lymph nodes. Tanaka, however, considers the invasion of the regional nodes as a very frequent occurrence with the endothelial tumors, but his cases are to be viewed with considerable doubt, as none of them were from the salivary glands, and the histories and the pathological reports would incline one to regard the cases which he describes as sarcomata, especially those arising in the skin. The case of Griffini and Trombetta may be an exception to the rule of the non-invasion of the lymph nodes. The tumor was cartilaginous and of sixteen years' duration. At the close of that time it began to grow rapidly, and on the death of the patient was found to involve the lung, the pleura, the cervical, and the bronchial lymph nodes. In the tumor masses in the pleura and the lung some cartilage was detected, but none in the lymph nodes. The tumor had invaded the bone marrow and the vessels of the neck, and sent long strands down along the channels of the neck, so that it is possible that the metastases were by direct extension from the primary growth. The authors class it as a chondrocarcinoma of the submaxillary gland, so that it may fall under the same class as Case IV, the drawing appended to the paper showing a growth of carcinomatous type.

The metastases of the mixed tumors are of two varieties, local and remote. In the first form the recurrence is usually of the same type as the original tumor; that is, the general morphology of the original growth is retained and the recurrence may contain cartilage, mucus, and hyaline tissues. When the recurrences extend over a long period the tumor may gradually lose its characteristic morphology and resemble a sarcoma

very closely (Case XXV). This change should be carefully distinguished from that in which the tumor stroma undergoes a sarcomatous change with the production of a typical sarcoma with rapidly growing and wide-spread metastases. In the secondary growths of this type the stroma retains no trace of the embryonic structures, no cartilage or hyaline tissue is present, and the tumor cells do not show their original alveolar arrangement. Cases XLI and XLII are examples of such changes. In a case reported by Barozzi and Lesné, in which a recurrent tumor occupied the entire left side of the face and neck, the cervical and tracheal lymph nodes were invaded by the new growth. The original tumor appears to have been not a cylindroma, as it is designated by the writers, but an epithelioma with mucous degeneration of the connective-tissue stroma. In fact, the term cylindroma as used by the French writers has not the same significance as when used by Sattler and other German writers, but in general may be considered as designating an epithelial tumor with degeneration of the stroma.

Occasionally the growth invades the wall of one of the large veins of the neck, and emboli are carried in this way throughout the body, as occurred in Case XLI of my series; but this is rare, and the growth, as a rule, remains fairly well localized, local recurrences being not infrequent unless the removal of the original growth has been very thorough, a condition often difficult of realization in the parotid growths owing to the close contact of many of the growths with the facial nerve. Case XXV is an excellent example of repeated recurrences extending over a long period of time, while Case X is an example of a prompt recurrence with a final radical removal of the growth. Cases XXVII and XXXVI are examples of frequent recurrences with the final death of the patient.

Billroth reports a case in which, during the course of twenty-three years, nine operations were performed to remove local recurrences.

The cases of primary endotheliomata of the cervical lymph nodes which exist in the literature (Zahn, Hoffmann, and Volk-

mann) ran an exceedingly malignant course, while the single case which the writer has had opportunity to observe was quite benign and did not recur after removal (Case XIX).

RÉSUMÉ OF THE MORPHOLOGY OF THE TUMORS.

The details of the microscopic description of the mixed tumors are best subdivided into two groups,—one embodying the structure of the stroma; the other, the structure of the parenchyma.

The connective tissue of the tumors is very variable in structure and amount. In the denser forms, especially in the tumors from the pharynx and in some of the parotid tumors, the connective tissue is arranged in very firm, dense bands traversing the growth, and also surrounding it, in the form of a firm fibrous capsule. The bands traversing the substance of the tumor divide it into a series of trabeculæ in which the cellular structures lie. These bands, as well as the capsule, stain intensely with the Van Gieson stain, and also take a very clear and sharp stain with the Mallory phosphotungstic acid hæmatoxylin, especially if, as Ribbert recommends, the material has been fixed in Zenker's fluid. There is only occasionally evidence of a basement membrane of connective tissue about the alveoli of the parenchyma cells such as exists in the normal parotid or submaxillary. The finer fibrillæ cannot be demonstrated between the cells of the alveoli nor between the cells of the solid strands of the so-called endothelial cells, even when the tissues are stained deeply with the phosphotungstic mixture or Van Gieson's stain.

The absence of connective-tissue fibrillæ between the cells of a tumor is usually regarded as indicating the epithelial origin of the tumor cells, since they are usually present between the cells in sarcomata. Some writers, notably Barth, claim to have been able to demonstrate the presence of fine fibrillæ of connective tissue between the cells of the so-called endothelial masses by means of special stains. Barth recommends Rosin's stain, which is a modified Ehrlich-Biondi tissue stain.

The staining solution is made by taking four centigrammes of the dry Ehrlich-Biondi mixture, dissolving it in 100 cubic centimetres of water, and adding to the solution seven cubic centimetres of a half per cent. aqueous solution of acid fuchsin. Paraffin sections remain in this for five minutes and are then washed for two minutes in water, differentiated for ten seconds in 1 to 2000 acetic acid, dehydrated in alcohol, cleared in xylol, and mounted in dammar. The nuclei are green, the connective tissues are red.

Barth's drawings are excellent, but not absolutely conclusive; and it seems possible that he has stained some of the spindle-shaped connective-tissue cells which often lie between the flat endothelial cells, and that true fibrillæ are not demonstrated. The writer has tried this method on a number of tumors of different types, and has not been able to demonstrate this condition; nor has it been possible to do so with the phosphotungstic acid method, though the fibrillæ can be easily shown with this stain between the cells of many of the sarcomata which have been used as a control for the method.

In the softer tumors the connective tissue is correspondingly looser in texture; it is often œdematous, and very frequently is replaced by myxomatous tissue. The myxomatous changes are frequently seen, but do not seem always to be due to a degenerative process, as was considered probable by Volkmann, but rather to an actual presence in the tumor of embryonic tissue of the myxomatous type. The evidences for this assumption lie in the nature of the tissue, which does not resemble the ordinary myxomatous degeneration in connective tissue, but is more like the tissue of the embryo with its long branching cells. The quite constant association of the myxomatous tissue with cartilage is another reason for assuming its origin to be embryonic, for, as will be seen later, there are many reasons for supposing that the cartilage is derived from the Meckel's or Reichert's cartilage of the developing embryo.

Embryonic connective tissue without myxomatous structure is frequently found in these tumors. It consists of a loose fibrous tissue stroma with spindle cells scattered through it in small numbers. The spindle cells form a portion of the fibrous net-work of the connective tissue by giving off from their

cytoplasm long fibres which, in properly stained specimens, can easily be traced for a considerable distance.

The cells of the stroma have been described more or less while discussing the structure of the connective-tissue elements, so that only a review is necessary here. These cells vary in number and morphology in the different tumors, depending largely upon the condition of maturity of the connective tissues present. The stroma of the dense growths contain but few cells, and these are of the familiar connective-tissue type; that is, of long spindle-shaped cells with small, evenly staining nuclei without definite chromatin net-work, and rarely showing mitotic figures. The tumors in which connective tissue of a more embryonic type is present, and the tumors of the previous group in which portions of the stroma have undergone a sarcomatous change, show cells with large nuclei and well-marked chromatin net-work. The cell body is more prominent and more sharply outlined and mitotic figures are occasionally seen. In the myxomatous and cartilaginous portions the cells are either the branching cells regularly seen in myxomatous tissue or they are the encapsulated cells of hyaline cartilage with their double nuclei. In the tumors examined by the writer no evidences of proliferation were found in either the cells of the myxomatous tissue or in those of the cartilage, though such appearances in the cartilage of these tumors have been noted by von Ohlen.

The large flat cells of the tumor parenchyma are also found scattered through the myxomatous portions of the new growth and about the periphery of the cartilage, which fact has given rise to speculations concerning the origin of the cartilage from the flat so-called endothelial cells, or of the flat cells from the cartilage. These flat cells may be few in number and diffusely scattered throughout the stroma, or they may be collected into strands spreading out diffusely through the myxomatous or fibrous tissue and also entering into close relationship with the cartilaginous areas. Some of these cells in the myxomatous portions may be observed to be closely connected with the stroma by giving off the fibrillæ into its sub-

stance, others retain the oval or polyhedral form of the flat epithelial cells lining the alveoli.

Giant cells are not uncommon, especially on the cellular borders of the myxomatous areas into which they often project. The mechanical conditions here which permit the free growth of the cells into the soft myxomatous areas may possibly account for the condition, especially as similar pictures have been seen in pleural growths where the same freedom of growth is possible.

Cartilage is found in about one-fourth of the mixed tumors of the salivary glands and of the facial region which the writer has been able to examine; other observers have found it in half the tumors examined. Osteoid tissue is fairly frequent, while bone is rare. Bone was present in no one of the tumors examined by the writer.

The cartilage is either hyaline or fibro-elastic. As a rule, there are numerous fine elastic tissue fibrillæ scattered through even the more typical hyaline cartilage in the form of a fine mesh-work easily demonstrable by Weigert's method for elastic fibres.

The cells of the cartilage are usually similar to those of hyaline cartilage under normal conditions; they may be encapsulated or free in the homogeneous stroma. Occasionally, however, there are variations in the arrangement and the number of the cartilage cells and tumor cells which render it easy to distinguish from the normal tissue. The most frequent anomaly is the presence of a large number of cells without the capsule which usually surrounds them. A number of cells may collect in small masses in the substance of the cartilage and calcification may take place, the salt deposited being most frequently the sulphate of calcium. Finally, the substance of the cartilage may soften and produce small cysts containing a clear brownish fluid. The cartilage may form a greater part of the tumor, or it may be very scanty in amount and merely scattered through the tumor in small islets. In all cases it is in very intimate connection with the connective-tissue stroma and cells, and also with the so-called endothelial cells of the tumor.

The *elastic tissue* content of these tumors is not mentioned in detail in any of the monographs on the subject. Indeed, the literature on elastic tissue in tumors is still meagre and contradictory in its statements. Melnikow-Raswedenkow found no newly formed elastic fibres in tumors, all those present were derived from the organs in which the growths occurred. He examined connective-tissue tumors, epithelial tumors, teratoid tumors and cysts, and concludes that there is but little elastic tissue in any one of these growths, and also that the elastic tissue of the organs invaded is only mechanically influenced by the tumor cells in their growth.

Williams, on the other hand, found that a few fine fibres are occasionally seen in the newly formed stroma of the carcinomata, but only in tumors in which the stroma was especially abundant.

Alice Hamilton describes a fibrosarcoma of the brain in which numerous elastic fibres could be demonstrated which she considered as newly formed, inasmuch as they were not confined to the region of the blood-vessels, which is the only site of elastic fibres in the brain substance. Huguenin, in an adenoma (?) of the testicle containing cartilage, glands, and epithelial masses, says that the cartilage in his preparations contained no elastic fibres, but admits that the stain was not entirely satisfactory, owing to the method of preserving the material. In some of my own specimens of mixed tumors of the testicle elastic tissue was very abundant throughout. Gliuski found little or no elastic tissue in a mixed growth from the œsophagus. K. Landsteiner is the only observer who mentions the abundance of the elastic fibres in the salivary tumors.

The elastic tissue in the mixed tumors is very much more abundant than in the sarcomata or carcinomata. In the latter it is largely confined to the pre-existent stroma, and there is only a moderate new production, and this in the region of the vascular system. In the mixed tumors, however, the stroma of the growth is penetrated by a fine mesh-work of fine and coarse fibres of elastic tissue. These are specially abundant in the dense fibrous tissue of the capsule and the trabeculæ of the

more fibrous growths. In the soft embryonic fibrous tissue of the more cellular tumors the elastic tissue is in the form of very fine branching fibrillæ having no connection with the blood-vessels. In the cartilaginous parts the elastic tissue penetrates all portions as a fine net-work, not so dense, however, as in true fibro-elastic cartilage. The elastic fibres usually encircle the alveoli in considerable numbers, but do not penetrate between the cells lining the alveoli. When the stroma cells diffuse out through the connective tissue, or even when they remain in solid strands, the finer elastic fibres often penetrate between the cells. The fibre net-work may surround a single cell or it may surround a group of several cells.

Blood-vessels are infrequent in these tumors, and when present seem to bear little or no relation to the cells of the parenchyma. They are usually seen in the connective-tissue trabeculæ of the more fibrous growths and present no peculiarities.

Small areas of fat tissue are to be found in a number of the mixed tumors inside the capsule of the growth and lying in the connective-tissue stroma. They are quite independent of the fat of the surrounding connective tissue, the gland with which the tumor is in relation, and are probably derived from the embryonic connective tissue which forms the stroma of the growth.

The same is probably true of small lymphoid areas which are not uncommon in the mixed tumors. Their derivation is in all probability the lymphoid tissue of the buccal and pharyngeal mucosa, and is especially well marked in the cysts and clefts from the branchial pouches which have persisted until adult life, and still retain a well-developed envelop of lymphoid tissue about the epithelium lining the cavity of the cyst or sinus.

The Cells of the Parenchyma.—The cells of the parenchyma of the mixed tumors are arranged either in alveoli or in solid strands, which are often connected with alveoli at some portion of their extent. When arranged in alveoli they are large and flat, resembling epithelial cells in their general grouping, but differing from ordinary epithelium in having

an oval homogeneous nucleus without a well-marked nuclear net-work, the entire nucleus staining diffusely. The cells under ordinary conditions do not show intercellular bridges nor spines, such as are frequently seen in epithelial cells. These cells may be high and cylindrical; they may be cuboidal or polygonal; and, finally, if the lumen of the alveolus be filled with accumulated material, they may be flattened out into low cells resembling the endothelium lining the blood-vessels. In a number of the tumors examined, instead of alveoli being present the parenchymal cells are in long strands, as above indicated, extending through the tissues closely attached to the connective tissue of the tumor and often containing long spindle-shaped cells of an evidently connective-tissue nature. The cells of the strands may also give off long fibrillar prolongations to the connective tissue. This can be best seen in the myxomatous portions of the tumor, for there the fibrillæ can be more easily traced.

As was stated under the heading of the fibrous stroma, no connective tissue can be made out between the parenchyma cells, either when they are in alveoli or in strands. When sections are stained either with Van Gieson or with Mallory's connective-tissue stain, fibrillæ can occasionally be demonstrated between the cells, but this appearance is due to the spindle cells lying between the others, and is not of constant occurrence. A basement membrane is not usually present about the alveoli, but the elastic fibres are occasionally very abundant around them.

In a few tumors the cells lining the original alveoli are crowded together by connective-tissue growth and degeneration, so that the lumen is lost and the whole structure distorted in much the same way as in an intracanalicular fibroma of the breast. Case LIX is an excellent example of this form of distortion. (Plate VIII, Fig. 2.)

An important point of difference between the cells lining the alveoli of this form of tumor and the cells of an epithelial new growth is that the normal endothelium lining the lymph spaces can generally be seen under a layer of epithelial cells,

while it cannot be so seen in the alveoli of the mixed tumor cells. That this is not always true can be seen in Case XX, where the so-called endothelial cells of the tumor can be made out advancing over the normal endothelium lining a lymph space, just as the cells from a carcinoma may be seen to advance over the endothelial cells of the lining of the lymph channels of a lymph node. (Plate II, Fig. 2.)

As previously stated, Volkmann claims that the so-called endothelial cells lining the alveoli do not shrink away from the connective tissue with which they are in contact, as is the case in carcinomata, even when the tissue is considerably shrunken by fixing agents. Borst and others have shown, however, that this distinction cannot be strictly held, for in some of the endothelial tumors the cells do shrink away from the connective-tissue walls of the alveoli, and in carcinomata it is easy to find areas where the epithelial cells remain in contact, even though there is considerable shrinkage during the hardening process. It is true, however, that the separation occurs more frequently in the carcinomata and is rare in the mixed tumors.

Epithelial cells with well-marked spines are more or less abundant in the parenchyma of eight cases in my series of fifty-nine. They are arranged very frequently in pearls, the centre of the pearl staining strongly with eosin, as in the pearls from the ordinary epitheliomata of the skin. When stained with Kromayer's modification of Weigert's fibrin method, well-marked keratohyaline granules can be made out in some of the cells at the periphery of the pearls, and also a moderately well-marked fibrillation which passes from one cell to the other. (Plate V, Fig. 2.) The intercellular bridges are well marked in many of the pearls and in some of the alveoli in which no pearl formation has taken place.

In six of the other tumors examined, which did not contain pearls, cell alveoli were found which bore a very close resemblance to the ducts of an atrophic salivary gland. These alveoli were lined with a single layer of cuboidal cells and possessed a well-marked basement membrane. (Plate I, Fig. 2.)

Three of the smaller tumors were embedded in paraffin

and sectioned in a complete series. In no one of them were well-marked epithelial spine cells demonstrated. A large number of sections from the other tumors were examined, but no spine cells were found; so the presence of epithelial spine cells cannot be regarded as a constant or even a frequent occurrence, as Hinsberg is inclined to believe.

Connected with the pearls, branching strands of cells are often seen, which lack the characteristic morphology of epithelial cells and resemble the strands considered by Volkmann as endothelial in nature.

DISCUSSION OF RESULTS.

If we look over the case histories of a series of tumors of the type which we have described, in order to obtain some clue to the conditions which surround their origin, we are struck, in the first place, with the fact that all these new growths arise in regions of the body which are characterized by two conditions,—one, the presence of complex organs either of epithelial or mesoblastic origin, and, secondly, from an embryological point of view, by an extremely complicated course of development.

Both of these conditions obtain in the facial region and in the region of the development of the kidney, ovary, and testicle, to which areas these complex tumors are practically confined, if we except the site of the postanal gut, where complex forms also occur under precisely the same conditions.

If we consider these tumors as a whole, we must notice that they contain elements which are derived from the mesoblast at a comparatively early stage of differentiation. Evidently, cells of mesoblastic origin must have been left in these situations at a period when they contained all these tissue possibilities and before a final differentiation took place, for the change into a definitive form of cell precludes the possibility of further differentiation; as, for example, the final changes of undifferentiated embryonic mesoblast into the highly specialized cell forms, such as muscle or cartilage, preclude further changes except of a regressive type.

It is interesting to observe more closely the association of these tumors and malformations which result from imperfect adjustment of the tissues which go to form the facial region. These malformations are the dermoids of the orbit and the eye, the cysts and fistulæ which arise from the imperfect closure of the thyroglossal duct or the branchial clefts, the imperfections from lack of union of the lateral processes forming the mouth and cheeks, and, finally, the malformations of the ear, with either an accessory tragus or mandibular or cervical tubercle. In Case L, a small congenital parotid tumor was present in the upper part of the parotid, while just behind it was a supernumerary spur of cartilage derived from the non-union of the spina helix with the helix. There was present also an auricular fistula in the helix resulting from the same lack of union between the helix and the spina. (See Schwalbe and Gradenigo.) The tumor was a complicated growth, containing among other things a considerable amount of hyaline cartilage; the spur, on the other hand, contained yellow elastic cartilage, and was therefore not, in all probability, derived from the same source as that in the tumor; but the connection of the tumor of the parotid with the other congenital lesions is strongly suggestive of the simultaneous displacement of both sets of remnants.

The derivation of the cartilage which these complex tumors contain has always interested pathologists. There are two chief possibilities to be considered; one, which has long been held, is that the cartilage is derived by a process of metaplasia from the connective tissue of the tumor or from the tumor cells; the other is that the cartilage is either a remnant left in the formation of the branchial arches, or that certain cells are left from that portion of the embryo which is to finally form these arches, and that these cells are capable of developing into either an undifferentiated fibrous or mucous tissue or into the more highly differentiated form of cartilaginous tissue.

Virchow's idea was that the cartilage originated in the connective tissue, much as cartilage arises from the periosteum of bone, and this view is developed in Volkmann's paper. The

latter holds that the process is "exceedingly simple," and consists in a chemical alteration of the intercellular substance by which the fibrillæ of the connective tissue are softened and dissolved into a more or less homogeneous mass of basement substance, and thus forms either cartilage or myxomatous tissue. The flat cells of the tissues then undergo a metamorphosis in response to that which has taken place in the connective tissue, and become either encapsulated cartilage cells or emit fibrillæ and become the branching cells of the myxomatous tissues. All transitions can be observed between the cells and the connective tissue; but the most frequent process is the transformation into myxomatous tissue first, and then an alteration of the cells and the stroma into cartilage. Volkmann and von Ohlen find that the cartilaginous portions are often the site of very active proliferation, and that they form long strands of cells similar to those seen in other parts of the growth. Against all these views are the facts that the cartilaginous tumors are of extremely slow growth clinically; that mitotic figures have not been found in the cells of the cartilage by the writer and many other observers; that the elastic tissue is not arranged in the cartilaginous portions as it would be if the pre-existing connective tissue had merely become softened, but is in fine fibrils scattered throughout; that the cartilage is not found in the metastases, but only in local recurrences; and, finally, that these degenerative changes in connective tissue with the formation of cartilage do not take place in other tumors which contain abundant connective tissue, but only appear in a certain narrow group of tumors which are in all probability congenital in their origin.

Cohnheim, in his lectures on general pathology, said long ago that "the germs of the cartilaginous tumors of the parotid region are unused remnants of the cartilaginous portions of the branchial arches."

Klebs believes that when the organism has reached a certain physiological point of development and the cells possess a degree of specific stability, that cartilage can only be produced from embryonic remnants.

Orth also holds the same view of the origin of the cartilage, while most of the special writers on the subject support Volkmann in deriving the cartilage from the connective tissue.

In general, it may be said that the idea of the change of one tissue into a closely related form is gradually losing the general acceptance which it once possessed, and such changes are more and more being considered as due to embryonic errors of development.

Ribbert, in his latest publication, when speaking of the metaplasia of connective tissue into cartilage or myxomatous tissue, says that such changes even within these narrow limits are very infrequent in their occurrence, and that there is considerable reason to suppose that these appearances may be due to embryonal misplacements of tissues. In another section he considers it probable that most, if not all, of the pure myxomata are due to some congenital remnant of mesoblast displaced at a stage when it contained the possibilities of myxomatous development. Lubarsch states that while it is undoubted that the "epithelia" lining the serous cavities and the blood-vessels can produce connective tissue, which can best be seen in the organization of thrombi and the inflammation and foreign body irritation of the serous cavities, the question of the metaplasia of endothelial cells into cartilage cells is more than doubtful. Benecke considers that this change is possible in tumors, but the condition may be due to an embryonic misplacement of cells. Certainly the fact cannot be regarded as proven. The possibility of the metaplasia of true ento- or ectodermal cells into connective tissue has never been positively shown. Kromayer's interpretation of the pictures which he obtained in the examination of the soft *nævi* of the skin has never been widely accepted, and the view of Unna that the *nævus* cells are epithelial in origin is now generally received. It is especially difficult to prove the metaplasia of epithelium into connective tissue in the skin because the epithelial cells become flattened and drawn out into long spindle-shaped forms which often lie in close connection with the connective-tissue fibrillæ of the pre-existing stroma, so that this apparent change into con-

nective-tissue cells is to be regarded as the result of mechanical action, and true connective-tissue cells in the biological sense have not been produced. This mechanical change may also occur in the epithelial masses of the salivary mixed tumors.

The main weight of the evidence seems to be on the side of the congenital misplacement of cells which have the power to form either cartilage or myxomatous tissue. The same explanation would account most simply for the presence of fat and lymphoid tissue in these tumors. Fat tissue is not ordinarily seen in tumors as a portion of the growth itself, but usually as a part of the tissue through which the tumor may be growing. But in many of the congenital tumors,—for example, those from the kidney,—whose origin from embryonic misplacements is more definitely settled than in the case of these complex tumors of the parotid, the presence of fat tissue and striated muscle in intimate relationship is regarded as a valuable evidence of the derivation of the tumor stroma from the mesoblast at a time when the kidney rudiments were in close contact with the muscle-plates of the middle layer of the embryo.

The examination of sections of human embryos of from six to twelve weeks of age shows that such embryonic displacements may easily occur in the region of the salivary glands. In transverse sections through the head of embryos of this age, the parotid and the submaxillary may be seen as small outgrowths from the floor of the mouth, lying almost in contact with the first and second branchial arches, or rather with the cartilage which these arches contain. Very often tubules of the gland may be found to be surrounded by the cells of the perichondrium.

Inasmuch as the arches reach their development at or about the fourth week, and at that time contain the cartilaginous tissue which forms Meckel's and Reichert's cartilages, while the parotid does not appear until the sixth or eighth week, for any embryonic remnant to contain both parotid and cartilage, the tissue must have been displaced before the fourth week. It is not therefore a portion of parotid tissue which is

displaced, but a portion of the epiblast which is to line the buccal cavity, together with some of the underlying mesoblast, the latter carrying with it the whole group of mesoblastic possibilities,—cartilage, myxomatous tissue, fat, and even muscle.¹ This necessarily early displacement of the tissues would make up the tumor accounts for the great variability of the mesoblastic and epiblastic structures present in the growth and the close intermingling of cartilage, myxomatous tissue, hyaline, fat, muscle, and bone, together with cells of both epithelial and connective-tissue types.

This early derivation of the remnants is also a point upon which Wilms has rightly insisted as rendering superfluous the explanation which Hinsberg finds necessary to make in order to account for the presence of cornified epithelium in the midst of these complex tumors. Hinsberg has to assume a metaplasia of the parotid glandular epithelium into epidermal cells; but if it be remembered that the displacement takes place before the buccal epithelium has become differentiated into parotid, and while it still retains the qualities inherent in that epithelium, that is, of forming epithelial cells for the lining of the buccal cavity, the assumption of metaplasia to account for the presence of the epidermal cells is quite unnecessary.

Hinsberg's further assumption that the epithelium might possibly be derived from the rudiments of the tympanum, which at this stage lies quite close to the parotid, is rendered doubtful by the fact that epithelium has been found in the submaxillary tumors, but the distance of the submaxillary gland from the tympanum is so great at all stages of development that such a displacement of tympanic epithelium is quite out of the question.

If now we turn from the elements of the stroma to the parenchyma of these tumors, the most striking feature is the presence of numerous cellular structures arranged either in solid strands or in the form of alveoli lined with flattened

¹ See report of a rhabdomyoma of the parotid by Prudden, *American Journal of the Medical Sciences*, 1883, page 438.

cells. Some of these cells are evidently epithelial in origin from their morphology, which is that of spine cells with well-developed intercellular bridges and keratohyaline granules or of tubules lined with cylindrical epithelium. The latter forms occur, so far as the tumors examined show, but rarely in any of the new growths from the facial region; they are frequent, however, in the tumors of the testicle. The other type of cells is that which has long been designated endothelial, because these cells possess a morphological aspect strikingly similar to the endothelia lining the lymph spaces.

Three views are possible as to the origin of the cells. One, that they are endothelial in nature and derived from the endothelium of the lymph spaces; second, that they are epithelial and derived either from a misplaced portion of the parotid or from a misplacement of the mesoblast and epiblast at a period when the cells have not as yet developed into the highly differentiated gland cells, but contain the possibilities of such development only, as is explained above in the discussion of the probable origin of the cartilage; third, that the tumors contain both endothelial and epithelial elements.

We will first take up the endothelial view as presented by Volkmann and his successors.

1. Is the endothelium capable of producing tumors? That this is probable is shown by the cases of tumors occurring in lymph nodes where epithelium cannot be present, and also in tumors of the bone marrow and the spleen, such as have been recently collected by Bovaird. The splenic tumors are, however, more probably hyperplastic growths than true tumor formations. The tumor reported by Sailer must also be regarded as a growth from the endothelium of the vein in which it was found. The tumors of the dura are no doubt of an endothelial character.

2. Are the parenchyma cells of the complex salivary tumors derived from the endothelium? The various facts which have been adduced to substantiate this view are:

(a) The cells resemble endothelial cells from a purely morphological aspect. That this is of slight value in the

determination is shown by Case VI of my own series, in which typical epithelial cells can be found in strands of cells otherwise conforming in all morphological points to endothelium. The same is true of cases reported by Hinsberg, Landsteiner, and Wilms in which spine cells have been found.

(*b*) The cells of the tumor are continuous with the cells of the peripheral lymph spaces in the capsule of the tumor, and that the endothelium of these spaces takes part in the growth of the tumor. Ribbert, Borst, and others have shown, however, that the lymph-space endothelium does not take part in the tumor growth, and that the spreading of cells of a new growth along lymph spaces, either with or without active growth of the lymph-space endothelium, is possible in carcinoma as well as in the so-called endothelial tumors. Ribbert has also called attention to the fact that the spaces which Volkmann regarded as normal lymph spaces in the fibrous tissue were not in fact lymph spaces, but tumor alveoli. The apparent new growth of endothelium in the spaces is due to the fact that the cells of the tumor grow over the endothelial cells already present and give the appearance of an hyperplasia of the pre-existing cells.

(*c*) The argument based upon the supposition that the cells of the endothelial tumors do not shrink away from the walls of the lymph spaces, and that the original endothelial cells cannot be seen under them, has been shown, by the observations of Borst, Lubarsch, and many others, to be incorrect. One of my own cases shows this shrinkage in many parts of the tumor. (Case XX, Plate II, Fig. 2.)

(*d*) Ribbert, Lubarsch, and others have shown that the fact upon which so much stress has been laid, that the solid strands of cells are in intimate connection with cells of undoubted mesoblastic origin, has but slight value in deciding that the two groups of cells are of identical origin, for such secondary unions of true epithelial and connective tissues are not infrequently observed in the epithelial tumors of the skin.

(*e*) The fact that the tumors are not closely connected with the salivary glands, and that the cells of the new growth

are not connected with those of the gland, but are separated from it by a capsule, does not prove that the cells of the tumor are not of epithelial origin, but only that they were separated from the glandular rudiments before the latter were enclosed in the capsule normally surrounding the gland. The formation of this capsule takes place about the fourth month of foetal life, while up to this time the acini of the gland are in close relationship with the periosteum of the inferior maxilla.

If we take up, on the other hand, the considerations which point to the view that the cells of these complex tumors are derived from the outer layer of the embryo, we find that they are based upon the following facts:

(a) Epithelial cells with intercellular bridges and keratohyaline granules are found in a few of these tumors, which are otherwise of a typical endothelial morphology. The epithelial cells lie in masses which would under ordinary circumstances be considered as very closely related to the surrounding connective tissues.

(b) Well-formed tubular glands with a basement membrane and a lumen filled with a homogeneous secretion are found in a few of these tumors, which are otherwise typically endothelial according to Volkmann.

(c) A great proportion of these tumors contain alveoli filled with a material resembling the colloid secretion of the thyroid or the material which may be found in the alveoli of an atrophic salivary gland.

(d) There is no connective tissue between the cells, as is generally the case in tumors of a mesoblastic origin. This is seen in stained preparations and in sections which have been either shaken out or pencilled to remove the cells of the parenchyma.

(e) These tumors occur only in or near epithelial structures and in regions in which congenital inclusions in the form of dermoids and cartilaginous remnants are fairly frequent. The intimate mixture of tissues of widely different type in a single tumor is a strong presumptive evidence that the growth is of congenital nature.

It is difficult to apply a suitable name to this group of tumors, and yet it is advisable to do so, if for no other reason than to call attention to the fact that they cannot be classed as adenomata, nor as epitheliomata or carcinomata, nor yet as sarcomata. From each of these groups of tumors the complicated growths which we have studied are separated by their morphology alone. The writer prefers to return to the old name of "mixed tumors," or, perhaps better, complex tumors, though the introduction of the latter might be justly criticised as adding a new name to our already complicated nomenclature.

The problem of the exact nature of these growths cannot be definitely settled so long as we must rest our distinctions upon morphological or histogenetic differences. The experiments which Ribbert, Lubarsch, and many others have carried out on the results of the transplantation of normal glandular tissues have given us only studies upon the atrophy and partial regeneration of fragments as grafted upon other tissues and under the most unfavorable conditions for permanent growth. We cannot expect too much of the transplantation of mature, highly differentiated tissues into an unfavorable environment, nor have the results of the transplantation of embryos or fragments of embryos afforded the results for which we hoped. The change of place and environment must be made at an earlier date and in a manner somewhat less crude than has been practised heretofore. Experimental teratology has at present only given results when applied to the lower forms of animal life.

CONCLUSIONS.

To sum up the results of this study in a few words:

I. There is a group of extremely complicated tumors occurring in the facial region which contain elements from both epi- and mesoblast in most intimate relation to each other.

II. The complicated structure of the stroma, containing as it does elements such as embryonic connective tissue, cartilage, bone, fat, and lymphoid tissue, and very rarely striated

muscle, is explained most easily by the assumption of an embryonic misplacement of mesoblast.

III. The structure of the parenchyma is so slightly characteristic in morphology that its epithelial nature in all cases can only be considered as probable; yet in about 24 per cent. of the tumors examined the presence of epithelium is undoubted. The form and relationships of the cells of the parenchyma do not furnish sufficient data to justify these cells being regarded as of endothelial origin.

IV. The theory of early embryonic displacement of epiblastic tissue during the process of formation of the parotid and submaxillary glands and the branchial arches may account for many of the morphological peculiarities of the cells of these tumors, especially the lack of many typical features which we associate with epithelium. The same condition may be seen in the epithelial cells of the congenital moles, in which the epithelium is with difficulty distinguished from connective-tissue cells, owing to its close connection with the stroma of the tumors and its undifferentiated type.

V. The mixed tumors of the salivary glands run a clinical course strikingly different from the sarcomata and carcinomata in that they are slow growing and generally benign. The regional lymph nodes are not invaded, and recurrences are likely to remain local in a considerable proportion of the cases.

BIBLIOGRAPHY.

Only those papers which are directly concerned with the salivary group of tumors are included here, and chiefly those which have appeared since 1896. Volkmann's "Monograph" contains a very complete collection of the articles before that date.

- Barozzi et Lesne. *Cylindrome de la region sous-maxillaire*. Soc. Anat. de Paris, March 19, 1897, p. 266.
- Barth, T. *Lymphangio-Sarkome des Mundbodens*. Diss., Jena, 1896. Also in *Beit. v. Ziegler*.
- Beadles, C. T. *Myxomatous Tumor of Submaxillary*. Trans. of London Path. Soc., Vol. xlviii, 1897, p. 66.
- Benecke. *Artikel Chondrom in Drasches Bibliothek der med. Wissenschaft*, 1900. *Ueber freies Wachstum metast. Geschwulstelemente in serösen Höhlen*. Arch. f. klin. Med., Band lxiv, p. 237.

- Berger. *Rev. de Chir.*, 1897, p. 361. Tumeurs mixtes du voile du palais.
- Biondi. Sei casi di chirurgia della glandola parotide. *Clinica chirurgica*, 1899, No. 1.
- Billroth. *Virch. Archiv*, Band xvii, 1859.
- Bland-Sutton. Tumors, Innocent and Malignant.
- Böhme. Zur Kasuistik d. Speicheldrüsengeschwulste. Diss., Berlin, 1892.
- Borrmann. Ein Blutgefässendotheliom, etc. *Virch. Arch.*, Band cli. Supplementheft, 1898, p. 151. Wachsthum d. Gefässgeschwulste. *Virch. Archiv*, Band clvii, 1899.
- Borst, Max. Das Verhalten der Endothelien bei der acuten und chronischen Entzündung. Würzburg, 1897. Verhand. der Physik-Medizin-Gesellschaft zu Würzburg.
- Bosc et Jeanbrau. Parotid Tumors. *Nouveau Montpellier Médical*, 1899.
- Böttcher. *Virch. Archiv*, Band xxxviii, p. 400.
- Bottini. *Chir. des Halses*, 1898.
- Bovaird. *American Journ. Med. Sciences*, 1900, p. 377.
- Bridgdon. *ANNALS OF SURGERY*, Vol. xxx, 1899, p. 219.
- Brosch, A. Zur Frage der Entstehung der Nierenzellen aus Endothelien. *Virch. Archiv*, Band cxliv, p. 289.
- Du Castel. Cyldrome de la région parotidienne. *Annales de Derm. et Syph.*, 1897, p. 187.
- Cavazzani, T. Angiosarcoma. *Rivista Veneta di Scienze Mediche*. Tome xxvi, 1896, p. 405.
- Chambard. *Revue de Méd.*, 1880.
- Chaput. *Bull. et Mém. Soc. Anat. de Paris*, 1900, ii, pp. 906-908.
- Collet, André. Des Tumeurs mixtes des glandes salivaires des levres. Paris, 1895. Abstract in *Cent. f. Path.*, 1896.
- Cone, S. M. *Bull. Johns Hopkins Hospital*, May, 1898, p. 114.
- Cordes, H. Ein Fall von Endothel. myxomatodes palati mollis. *Deut. med. Woch.*, 1900, No. 35.
- Curtis, B. F. *The Post-Graduate*, 1898, p. 25.
- Curtis et Phocas. *Arch. prov. Méd.*, 1899.
- Degen, D. Ein doppelseitiges Sarkom der Parotis. Diss., Freiburg, April, 1900.
- Delabarberie. *Arch. gén. d. Méd.*, 1890.
- Dunbar and Potel. Tumeurs bénigne du voile du palais (Fibroma). *Echo. méd. du Nord.*, 1900, p. 588.
- Dutton, T. E. *Liverpool Medico-Chir. Journal*, 1898, xviii, p. 369.
- Eberth and Spude. Familiäre Endothelioma. (In white mice.) *Virch. Archiv*, Band cliii, 1898.
- Eisenmenger. Die plexiformen Sarkome des Gaumens. *Deut. Zeit. f. Chir.*, 1894, Band xxxix, p. 1.
- Elsching, A. Haemangioendothelioma tuberosum multiplex. *Wiener med. Presse*, 1896, p. 169, No. 5. (Skin Tumor.)
- Ernst. Ueber diffuse multiple Angio-Lipombildung mit Endothel-Wucherungen. Diss., Freiburg, 1896.
- Finger, J. Endothel. fibrosum der weichen Hirnhaut und Bemerkungen über Endothel und Endotheliome überhaupt. Diss., Würzburg, 1897.

- Fürstenheim, W. Kiemengangshautauswüchse mit knorpeligem Gerüst. *Jahrb. f. Kinderheilk.*, 1895, Band xl.
- Gaucher. Epithel. prim. de la rate. Thèse de Paris, 1882.
- Gevaert. Tumors of Palate. *Belgique Médicale*, 31 mars, 1898. (Unimportant paper, chiefly clinical.)
- Gliuski. *Virch. Archiv*, 1902, p. 381.
- Glockner. Riesenzellen u. endotheliale Geschwülste. *Beit. v. Ziegler*, xxvi, 1899, p. 73.
- Gouguenheime et Ripault. Contribution a l'étude des tumeurs bénignes du voile du palais. *Annales des Maladies de l'oreille, du larynx*, 1896, xxii, pp. 1-9.
- Gradenigo. Missbildungen der Ohrmuschel. *Archiv f. Ohrenheilk.*, Band xxxiv, 1893.
- Griffini and Trombetta. *Atti. d. R. Accad. di Torino*, Tome xviii, 1883.
- Gruenhagen, E. G. Beiträge zur Lehre von den Speicheldrüsen Tumoren. Diss., Berlin, 1898.
- Hamilton. *Journ. of Experimental Medicine*, 1899.
- Hammer. Tumoren des Oberkiefers und angrenzender Gegenden. *Virch. Archiv*, Band cxlii, p. 503.
- Hansemann. *Path. Anat. et Hist. des Carcinoms. Deut. med. Woch.*, No. 33, 1901, p. 554. Ueber die Bezeichnung Endotheliom. *Deut. med. Woch.*, 1896, Nos. 4, 14. *Verh. d. Naturforscher Versam.*, Frankfurt, 1896. Bösartige Geschwülste, 1902, p. 62.
- Haug. *Arch. f. Ohrenheilkunde*, Band xliii, p. 10, 1897. (Ear cases.)
- Henkel, Max. Beiträge zur Histiogenese der Parotisgeschwülste. Inaug. Diss., Berlin, 1896.
- Hess, F. Beiträge zur Geschwülstlehre. Inaug. Diss., Bonn, 1896.
- Hinsberg. Beit. zur Entwicklungsgeschichte u. Natur d. Mundspeicheldrüsen Geschwülste. *Deut. Zeit. f. Chir.*, Band li, 1899, p. 281. *Beit. z. klin. Chir.*, 1899, Band xxiv, p. 275.
- Von Hippel. *Ziegler's Beit.*, 1893.
- Homp, G. Angiomyxosarkom d. Thränendrüse. Diss., Königsberg, 1896.
- Huguenin. *Virch. Archiv*, 1902, p. 396.
- Hutchinson, J., Jr. Adenochondroma of the Submaxillary Gland. *Trans. London Path. Soc.*, Vol. xlviii, p. 63.
- Janssen. *Virch. Archiv*, 1895, Band cxxxix.
- Jawenko. Mischgeschwülste d. Parotis. Diss., Würzburg, 1897.
- Jolly, J. Étude Anatomopathologique d'un angiome sarcomateux. *Arch. de Méd., Exp.*, Tome vii, 1895, p. 621.
- Josuran, C. Veränderung d. Epithels in chron. entzündeten Parotis. Diss., Zürich, 1898.
- Kaufmann. Parotissarkome. *Arch. f. klin. Chir.*, Band xxvi, p. 672.
- Klaatsch. Ueber d. jetzigen Stand der Keimblattfrage mit Rücksicht auf die Pathologie. *Münch. med. Woch.*, 1899, No. 6, p. 169.
- Klein, G. Endotheliale Metastasen des Carcinoms. *Verh. d. Deutsch. Naturf. und Aerzte*, 1896, p. 18.
- Koch, U. Ueber Parotis Tumoren. Diss., Freiburg, 1897.
- Kolossow. *Biol. Cent.*, Band xii, 1892, p. 87. *Arch. f. Mik. Anat.*, Band xlii, p. 318.

- König, F., Jr. *Cent. f. Chir.*, No. 27, 1899, p. 19. *Verh. Deut. Gesell. f. Chir.*
- Koslowski, B. S. *Chirurgie*, 1898, p. 447. (Russian.) Abstract in *Centralbl. f. Chir.*, 1899, No. 9, p. 283.
- Kretz. Neoplasms in same Individual with Metastases. *Wiener klin. Woch.*, 1892, No. 11.
- Krohn, Wilhelm. Ueber Geschwülste der Submax. Speicheldrüse. *Inaug. Diss.*, Halle, 1899.
- Kromayer, E. Zwei Fälle von Endothelioma tuben. Coll. des., etc. *Virch. Archiv*, Band cxxxix, p. 282. Zur Histiogenese der weichen Hautnaevi, Metaplasia von Epith. zu Endothel. *Dermat. Zeit.*, Band iii, p. 265
- Kühne. Mischgeschwülste der Parotis. *Diss.*, Freiburg, 1895.
- Küttner. *Beit. z. klin. Chir.*, 1896, Band xvi.
- Lambrecht et Gaudier. *Echo Méd. du Nord.*, Tome i, p. 19.
- Landsteiner. Mischgeschwülste d. Speicheldrüsen. *Zeit. f. Heilkunde*, 1901, p. 1.
- Langhans. *Casuistische Beit. z. Lehre von den Gefässgeschwülsten*. *Virch. Archiv*, 1875.
- Limacher, F. Ueber Blutgefässendotheliome der Struma, etc. *Virch. Archiv*, Band cli, Supplementheft, 1898, p. 113.
- Linser. Verkalkte Epitheliome u. Endotheliome. *Beit. v. Bruns.*, xxvi, 1900, p. 595.
- Lotheissen, G. Ueber die Geschwülste der Gland Submax. *Beit. v. Bruns.*, 1897, Vol. xix.
- Löwenbach. Z. Kennt. der Geschw. der Submax. Speicheldrüsen. *Virch. Archiv*, 150.
- Lubarsch. *Ergebnisse*. Jahrg. i, Abt. 2, S. 366. Jahrg. ii, S. 592. Zur Lehre v. d. Geschwülsten, 1899, p. 233. *Verh. d. Ges. Deut. Naturf. und Aerzte*, Band ii, 1895. *Arbeiten aus der Hygien. Instituts zu Posen*, 1901, p. 205. *Zeit. f. klin. Med.*, 1902, p. 491.
- Marchand. *Verh. d. Deut. Gesell. f. Path.*, 1899.
- Mauclaire and Durrieux. Tumeur mixte du voile du palais. *Bull. Soc. Anat. de Paris*, 1897, p. 609.
- McWeeny, E. J. Endothelioma (Tumor contained bone and cartilage.) *Trans. of Royal Acad. of Medicine in Ireland*, Vol. xii, 1895, p. 366.
- Melnikow-Raswedenkow. Elastische Gewebe. *Beit. v. Ziegler*, Band xxvi, 1899, p. 546.
- Meneau. Un cas d'hematolymphangioma circonscrit. *Mém. et Bull. de la Soc. de Méd.*, etc., de Bordeaux, 1894-1895, p. 334.
- Mikulicz and Kümmel. *Krankheiten d. Mundes*, 1898, p. 180.
- Minot, C. S. Classification of Tissues. *Boston Society of Medical Sciences*, December 19, 1899.
- Mixer. *Boston Med. and Surg. Journal*, 1896, p. 137.
- Morestin. *Traité de Chirurgie*, par Dentu et Delbet, 1898, pp. 296 and 406.
- Morpurgo. Endothelioma. *Atti della Accad. delle scienze med. e nat. di Ferrara*, Vol. lxix, 1895.

- Mourie, Pierre. Endothelioma (?). Contribution à l'étude du cancer primitif du voile du palais et de la luette. Bordeaux. Thèse, 1895.
- Mulert, Willy. Die gutartigen Tumoren der Zungenbasis. Diss., Würzburg, 1895.
- Nasse. Arch. f. klin. Chir., Band xlv, p. 233.
- Nicoladoni, C. Adenom aus der Wange. Deut. Zeit. f. Chir., Vol. i, 1872, p. 432.
- v. Ohlen. Beit. v. Ziegler, Band xii.
- Otto, Ernst. Diffuse multiple Angio-Lipombildung mit Endothelwucherung. Diss., Berlin, 1895.
- Parmeijer. Mixed Tumor of Parotid. Diss., Leyden, 1901.
- Peters. Ueber Path. Cölomepithel Einstulpungen bei menschlichen Embryonen. Verh. d. Deut. Gesell. f. Gynak., 1897, p. 524.
- Picou et Ramond. Splenomegalie primitive. Arch. d. méd. exp., 1896, p. 169.
- Pitance. Thèse de Paris, 1897. (Quoted by Morestin.)
- Polak, Daniels. Stroma in Sarcoma. Virch. Archiv, Band clxv, p. 238.
- Pollack. Arbeiten aus der Hygienischen Instituts zu Posen, 1901, p. 160.
- Pollman, L. Ein Endotheliom der Pleura und des Peritoneums. Ziegler's Beiträge, 1899, p. 37.
- Ponsot, R. Tumeurs de la glands sous maxillaire. Thèse, Lyon, 1894-1895.
- Pupovac, D. Ein Beitrag zur Casuistik und Histologie der sogen. Endoth. Deut. Zeit. f. Chir., Band xlix, 1898, p. 77.
- Pussacq-Larcebau, T. B. Étude sur les tumeurs bénignes du Pharynx buccal et inferior. Thèse, Bordeaux, 1895.
- Putiata. Virch. Archiv, Band lxix, p. 245.
- Ribbert. Deut. med. Woch., 1896, No. 1. Mallory Stain for Fibrous Tissue. Cent. f. Path., 1896, p. 427. Vierteljahresschrift d. Naturf. Gesell. Zürich, 1896.
- Riedel, W. Pap. Endothelioma. Diss., Greifswald, 1898.
- Ritter, C. Fettgehalt in den Endotheliomen des Knochens. Deut. Zeit. f. Chir., Band l, 1899, p. 349.
- Roughton. Tumors of the Palate. (Nothing new.) British Journal of Dental Science, Vol. xxxix, 1896.
- Sailer. Primary Endothelioma of the Left Superior Pulmonary Vein. Contribution from the William Pepper Laboratory of Clinical Medicine, 1900.
- Schellong, C. Ueber Geschwülste des weichen Gaumens. Diss., Göttingen, 1897.
- Schwalbe, E. Endothelioma. Vich. Archiv, Band xlix, p. 451.
- Schwalbe, G. Das äussere Ohr. Bardeleben's Handbuch der Anatomie, 1898, p. 149.
- Scriba, M. Endothelioma. (Paper read at the XIIth Congress, Moscow.) Centralbl. f. Chir., 1897, p. 1039.
- Spuler. Ueber den feineren Bau der Chondrome. Beit. v. Zieg., 1902, p. 263.

- Ssobolen. Zur Lehre von d. Endothel. Neubildungen. Virch. Archiv, Band clxi, p. 50. (Doubtful case from intestine.)
- Steinhaus. Mischgeschwülste der Mundspeicheldrüsen. Virch. Archiv, Band clxviii, 1902, p. 233.
- Stengel, Hans. Ein Fall von Endothelioma Sarcomatosen des Oberkiefers. Diss., Würzburg, 1896.
- Sutke, H. Beit. z. Keimt. d. Metastasen d. prime. Nieren-Carcinom. Virch. Archiv, Band clxviii, p. 305.
- Tanaka. Ueber die klinische Diagnose von Endotheliomen und ihre eigenthümliche Metastasenbildung. Deut. Zeit. f. Chir., 1899, p. 209.
- Tervaert and de Jong. Arch. f. Ohrenheilk., Band xliii, 1897, p. 53. (Ear cases.)
- Thorel. Ergebnisse, Lubarsch-Ostertag, 1898, p. 235.
- Tusini, G. Endothelioma. (Two parotid tumors.) Festschrift for Durante, Vol. ii, p. 85.
- Unna. Epithel. Abkunft der Naevuszellen. Virch. Archiv, Band cxliii.
- Vincentiis, Carlo. Endothelioma adiposa. Rivista Clinica, 1893, No. 7.
- Volkmann. Ueber endotheliale Geschwülste. (Very complete literature up to 1896.) Deut. Zeit. f. Chir., Bd. xli, 1895, p. 1.
- Waldeyer. Endothel. und Epithel. Cinquantenaire de la Soc. de Biol. Vol. Jubilaire, 1899, p. 531. Arch. f. mik. Anatomie, Band li, 1900, p. 1.
- Williams, Alice. Journal of Experimental Medicine, Vol. v, 1900, p. 131.
- Williams, H. N. Festschrift for Welch, 1901.
- Wilms. Embryome und Embryoide Tumoren des Hodens. Deut. Zeit. f. Chir., Band xlix, 1898, p. 1. Mischgeschwülste, Heft 3.
- Winkler, Karl. Betheiligung des Lymphgefäßsystems an der Verschleppung böartiger Geschwülste. Diss., Breslau, 1898.
- Wlasso. Sarcome angioplastique. Virch. Archiv, Band clxix, p. 220, 1902.
- Wojtkiewicz, S. Knorpelhaltigen Auswüchse am Halse. Diss., Zürich, 1900. (Contains a good discussion of the literature of the subject.)
- Ziegler, H. E. Coelemfrage. Verh. d. Deut. Zoolog. Gesell., 1898.

OPERATIVE REMOVAL OF A TUMOR OF THE LIVER.¹

REPORT OF A CASE OF RESECTION OF THE LIVER FOR GUMMA ; CHOLECYSTECTOMY.

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THE case forming the basis for this report presents some interesting features with regard to the difficulties in arriving at a conclusion respecting the exact pathological process under observation after exploratory incision, and emphasizes how difficult it is to give a scientific and consistent prognosis in a given case until all the means to this end have been employed with care and deliberation. It also shows that an extensive portion of the liver may under certain conditions be removed without the occurrence of alarming or uncontrollable hæmorrhage; a consideration which has no doubt frequently deterred surgeons from making the attempt at enucleation of neoplasms in this situation.

History.—M. F., aged twenty-six years, married at twenty-one, has had two children with normal labor and two miscarriages at the third month, unattended with untoward occurrences. Denies absolutely any specific infection. Dr. Louis Mooney, her family physician, went very thoroughly into this question with a negative result. Has always been slender and readily fatigued, but never seriously ill. Eight months ago began to suffer from distress and some dull pain in the epigastric region; the pain and discomfort are not influenced by ingesta, nor have there been any symptoms pointing directly to the stomach. About seven months ago she noticed a small mass on the right side corresponding to the anterior edges of the eighth and ninth ribs; the mass was not at first tender nor particularly painful; however, it steadily

¹ Read before the University Medical Society, December 7, 1903.

increased in size; latterly the pain increased to a considerable extent, and recently has become sharp in character. Occasionally the patient vomited.

Examination, November 3, 1903.—The patient is slender, rather anæmic, but not cachectic; there is no jaundice, and, except for a slight indolent papular acne on the face, the complexion is clear; the conjunctivæ are also clear. There is no palpable enlargement of the glands and the mucous surfaces appear healthy, no tenderness over the tibiæ, in fact there is no discoverable manifestation of ileus. The facial expression is serene and does not bespeak extreme suffering. The pulse and temperature are normal, the tongue is moist and clean. She has not vomited blood at any time nor passed any per rectum. The abdomen is normal in outline, though rather flat. At the site of the anterior edges of the right eighth and ninth ribs a mass about the size of an orange is readily palpable; it is apparently continuous with the liver, is hard, tender, and evidently adherent to the anterior abdominal wall. There is no symmetrical enlargement of the liver. The percussion note over the mass is flat.

The Diagnosis.—Three things were considered,—cholelithiasis, duodenal ulcer, and neoplasm of the gall-bladder, liver, or pylorus. Regarding cholelithiasis, the pain is not paroxysmal, nor was there any history of gall-stone colic. A radiograph under exceptionally favorable conditions gave a negative result. Duodenal ulcer was excluded on the absence of hæmatemesis; also it was considered that, while a duodenal ulcer could give rise to a thickening of the pylorus and cause adhesion to the parietal peritoneum, it would probably be located lower down and would not reach the size manifest in this case. The case was believed to be one of neoplasm of either the gall-bladder or the liver tissue immediately contiguous to it, and in view of the age of the patient, the evident involvement of surrounding tissue (the peritoneum) was probably a sarcoma. Gumma, in view of the history, was not considered.

The Operation, November 10, 1903.—Nitrous oxide-ether narcosis. Under narcosis, the mass was more readily palpable, and seemed to extend towards the median line, consequently a celiotomy at the centre of the right rectus was made, and the mass found adherent to the parietal peritoneum, from which it was readily separated. The view thus obtained showed a hard

mass the size of a large orange close to the gall-bladder. There was a narrow rim of normal liver tissue between the tumor and gall-bladder, and the latter, also the biliary ducts were normal, showing that the process was not the result of extension. The peritoneal sac was packed off with gauze, the mass seized with the left hand and rapidly enucleated by bluntly tearing through the surrounding normal liver tissue with the closed scissors. The trabeculae of Glisson were clamped before division in order to control the branches of the hepatic artery. The venous hæmorrhage was considerable but not alarming, which was attributed to the fact that the larger venous trunks from the portal vein are located farther back near the transverse fissure, and in this case the field of operation involved the smaller ramifications in a portion of the organ aside and anterior to the track of the main blood-flow. Temporary tamponade with gauze saturated with hot saline solution effectually controlled the bleeding.

The gall-bladder was removed for the reason that when the mass was enucleated the thin layer of normal liver tissue separating it from the gall-bladder was also removed; this left the gall-bladder without support and a cholecystectomy was done. The cystic duct with its small artery was deligated, and the stump touched with pure carbolic acid. The wound in the liver was approximated with deep sutures of No. 2 chromic gut; a round needle of large size and full curve was used; the stitches showed no tendency to tear out. This latter measure effectually arrested the oozing from the raw surfaces of the liver wound. A drainage tube was carried down to the site of the liver wound and the superficial wound closed in the usual way. The patient reacted nicely from the operation.

At the time of the operation, the tumor was regarded as a sarcoma. The subsequent treatment of the case was that usually employed in abdominal section. Unfortunately, infection occurred in the track of the drainage tube, and the constitutional disturbances in consequence were for a time alarming. After thorough cleansing of the wound, this was arrested, and the patient made a rapid recovery.

Dr. Henry Rogers, who kindly made the microscopical examination, made a preliminary report that the tumor was probably a round-celled sarcoma; later, and after more extended examination, Dr. Rogers stated that the tumor was undoubtedly

a gumma. It is to be borne in mind that there is no history of syphilis, that the woman at the time of the operation presented no discoverable evidence of the disease, and that the clinical diagnosis during the operative procedure was sarcoma. The specimen was further submitted for examination to Professor E. K. Dunham and Dr. Harlow Brooks, of the Pathological Department of the New York University and Bellevue Hospital Medical College, both of whom regard the growth as syphilitic.

Anschuetz, in an article in the "Sammlung klinischer Vorträge," Nr. 356-7, Leipzig, 1903, issued July, 1903, says that "resection of the liver for gumma has no sense; an exploratory celiotomy and the discovery of a gumma should be followed by immediate closure of the wound and subsequent administration of mercury and potassium iodide; an opinion in which Bergman concurs." If the case here reported is indicative of the difficulties encountered in arriving at a conclusion in the matter, it would appear safer to remove the neoplasm, more especially if the removal involve no dangerous surgical proposition. Again, it is more than probable that a gumma of considerable size will not yield to constitutional treatment, and if the growth be situated near the gall-bladder and break down, very serious complications may be regarded as logical outcomes.

With regard to the results of resection of the liver for neoplasm, an analysis of ninety-six cases collected by Anschuetz shows the following:

Of the total ninety-six cases, seventy-five recovered, seventeen died from the operation. Ten were done by excision, tamponade, and compression; one died. Of seven done by thermocautery, all recovered; twenty-five done by excision and deep ligature, two died. Of six done by preliminary clamping and excision, two died. Of twenty done by intrahepatic ligature and excision, six died, and of twenty-four done by elastic ligature, six died. Of the entire number, 12½ per cent. were done for gumma; a fact showing that the admonition expressed by Anschuetz had not been regarded very frequently, probably

for the same reasons which obtained in the writer's case. Of these twelve cases, two died, four were excised, and bleeding controlled by tampon; all recovered; one excised and the liver wound closed by suture, which recovered. Seven were removed by elastic ligature, two died, and two were excised after preliminary intrahepatic ligature; both recovered. The two fatal cases were reported, one by Tricomi, in 1895, in a woman forty-five years of age, who died on the third day from collapse, and the other by Tuffier, who removed the entire left lobe of the liver for multiple gumma in a woman of middle life. The subsequent history of the case showed that no doubt the conclusion of the pathologist was correct. After three weeks from the time of the operation, convalescence did not progress as rapidly as was expected, and the patient suddenly developed an urticaria of most distressing severity. This was at first believed to be due to the disturbed intestinal function, owing to the fact that the biliary secretion had been disturbed by the cholecystectomy. No doubt this was a factor in the case, however; a mild enlargement of the inguinal glands accompanied the skin manifestations, and, as the pathological reports arrived at about this time, the patient was subjected to inunctions of 20 per cent. oleate of mercury, with the result that her general condition improved at once. The iodide of potassium was then ordered in rapidly increasing doses, and at the present time the patient's recovery is complete.

THE APONEUROSSES THE SUPPORTING STRUCTURES OF THE ABDOMINAL WALL; THEIR APPROXIMATION FOR THE PREVENTION AND CURE OF HERNIA.

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OF the various structures entering into the composition of the belly wall,—skin, fat, superficial fascia, aponeurotic laminae, muscle, transversalis fascia, and peritoneum,—the aponeuroses are the chief factors in the prevention of hernia. Neither the skin nor peritoneum offer much resistance to visceral protrusions, and that offered by muscles alone is not great when unprotected by fibrous covering. Witness hernia of muscle itself when, for instance, the sheath of the rectus is wounded. The protection of viscera and the production of movements constitute the principal rôle of the four flat abdominal muscles. The bellies of the transverse and oblique muscles fill in the space between the lower borders of the costal cartilages and the crest of the ilium on the sides of the abdomen, where hernia is least apt to occur, while behind this point the aponeurosis of the transversalis divides into three layers separating and giving support to the lumbar muscles. Anteriorly, the aponeurosis of the oblique and transverse muscles cover and support the whole front of the belly for an area extending from without the borders of the recti on the sides, and from the ensiform cartilage to the pubes in front. The aponeurotic layer of the external oblique is of the greatest importance, stretching, as it does, from beneath the pectoral muscles over the recti to the symphysis, and from the crest and anterior superior spine of the ilium to the spine of the pubis, forming Poupart's ligament and the pillars of the abdominal ring. It is mainly owing to weakness or faulty approximation of this structure that hernia results. The apo-

neurosis of the internal oblique, beginning well outside the rectus, divides into two layers at the outer border of the upper three-quarters of this muscle, one layer passing in front and the other layer behind the rectus to form its sheath, and uniting in the middle line.

While in the lower quarter of the rectus the aponeurosis of the internal oblique does not divide, but passes over the front of the muscle. The aponeurosis of the transversalis is broad, its upper three-fourths passing behind the rectus, blending with the aponeurosis of the internal oblique in front and the transversalis fascia behind, while its lower fourth passes in front of the rectus and, with the upper three-fourths, is inserted in the middle line (Fig. 1). All the aponeurotic layers pass in front of the lower fourth of the rectus; none behind this part.

The linea alba, formed by the blending of the transverse and oblique muscles, is wider above, and is of considerable breadth here when the abdomen has been distended, as by pregnancy. In operations for umbilical hernia or separation of the recti, the linea alba will often be found to afford sufficient tissue for making flaps without encroaching on the sheath of the rectus. As there is an aperture in the aponeuroses at the umbilicus, hernia in this region is only covered by peritoneum, transversalis fascia, and skin in most instances; but when, owing to separation of the recti, a large area of aponeurosis exists in the middle line, it will not uncommonly be found that this enters into the covering of umbilical hernia, particularly in large herniæ which have encroached upon the abdominal wall. In these it is especially necessary to find sufficient material for flaps in performing overlapping of the aponeurosis; therefore part of the base of the sac, composed of peritoneum and aponeurosis, may be utilized for this purpose. In a recent case of operation for ventral hernia with diastasis of the recti, it was noticed that the hernial covering consisted only of skin and peritoneum in the most central and superficial part, while about the periphery the aponeurosis entered into its composition. This was an incisional hernia following an operation

FIG 1

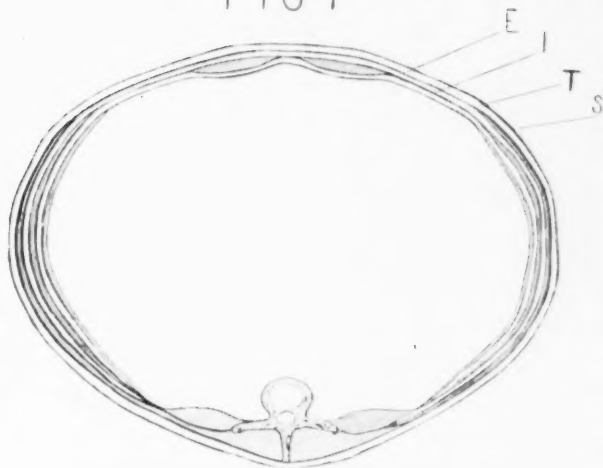


FIG. 2



FIG. 3

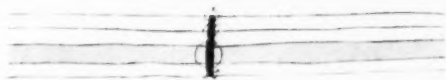


FIG 4

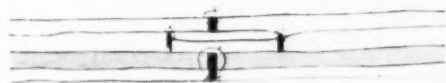


FIG. 1.—Cross-section of abdominal parietes showing the arrangement of aponeuroses in the upper three-fourths of the belly. E. Aponeurosis of external oblique. I. Aponeurosis of internal oblique. T. Aponeurosis of transversalis. S. Skin.

FIG. 2.—S. Skin. A. Aponeurosis. M. Muscle. P. Peritoneum. Mass or through-and-through suture of abdominal wall showing thinning of wall through tension of stitches and direct line of broad scar tissue from peritoneum to skin. More or less puckering of the layers and lack of or faulty approximation of the aponeurosis—which are not uncommon—are not shown.

FIG. 3.—Suture of the abdominal wall by layers. There is good approximation of like structures, but a weak spot in the direct line of the cicatrix from peritoneum to surface, which often results in hernia.

FIG. 4.—Closure of the abdominal incision by overlapping the aponeurosis. There is no direct line of scar formation from peritoneum to skin, but instead there is a doubling of the strongest layer in the wall interposed right in the path of hernia. The broad line of union between the flaps of aponeurosis making a breaking down of the wound an impossibility.

done in the middle line some years before by an unknown operator, and the result showed the effect of not properly approximating the aponeurosis in closing the incision.

Let us now consider the more common methods of making and closing the abdominal incision so far as they relate to the prevention and cure of hernia. We will analyze them from two points of view. 1. Their anatomical correctness. 2. Their clinical results. In the case of the earliest method, that of the so-called through-and-through or mass suture penetrating all layers of the wall from peritoneum to skin, several faults are apparent. Like structures are not accurately approximated; the peritoneum may be separated by bulging muscle; the aponeurosis is not properly coapted; the layers are puckered and suffer considerable tension at points where the stitches are placed resulting in thinning of the walls. Faulty approximation leads to a wide scar formation, and this, being weak tissue and extending in an unbroken line from peritoneum to skin, readily yields and gives rise to abdominal hernia which has been justly styled the "one blot upon abdominal surgery" (Fig. 2). Indeed, so late as 1895, Winter in *La Semaine Médicale*, relates that postoperative hernia had resulted in about one-third of 1000 cases of laparotomy done in the various hospitals of Berlin by the older method of mass suture.

Next came suturing of the separate layers or tiers. While it is true that by this procedure close approximation of like tissues, freedom from tension, and a linear scar are secured, yet the cicatricial tissue being continuous in the line of incision through the whole substance of the wall, hernia is a frequent occurrence. For example, such excellent operators as Bull and Coley report twelve relapses out of twenty-one cases of ventral and umbilical hernia done, as Coley writes me, by suture of separate layers. These cases are, as a rule, extremely unfavorable in possessing exceptionally weak walls; but when we compare this result with that of almost complete success in similar cases obtained by overlapping the aponeurosis, we find that the comparison does not reflect credit on suture of separate layers alone as a means of preventing or curing hernia in weak ab-

dominal walls (Fig. 3). "Comparisons are odious," but often instructive.

A modification of the suture in tiers is a common procedure among German operators in performing abdominal incisions. This consists in dividing the various layers in the same parallel lines, but in different vertical planes. Thus the incision through the aponeurosis and muscle would not be made immediately under the skin incision, but a little to one side; while that in the peritoneum would not be done immediately beneath the division of the aponeurosis and muscle, but a little to one side under the skin incision. This method results in the formation of linear scars which are immediately superimposed by sound tissue in the layer above,—a considerable advance in the way of affording increased resistance to intra-abdominal pressure.

Later came the devices, as McBurney's and Stimson's, which, while retaining the method of apposition in layers, so perform the division in making the abdominal incision that the lines of incision, and therefore union, cross each other. Thus the common name of "gridiron incision" for McBurney's operation for appendicitis. In this incision, as is so well known, the skin and aponeurosis of the external oblique are divided in a line parallel to the latter's fibres over McBurney's point, and then the internal oblique and transversalis muscles are separated by blunt dissection in the direction of their fibres, which extend at almost right angles beneath the incision in the external oblique. In the last step the peritoneum is divided in the same line as the muscular separation. It is an almost ideal operation anatomically in that there is no transverse division of muscular or nerve fibres, and in the fact that muscular contraction closes the opening in the belly wall. The only weak spot is at the intersection of the lines of incision, and this is so small as to be negligible. For the prevention of hernia, this operation is wellnigh perfect: I can find but one case of hernia following it in looking over the literature upon the subject. While it requires more skill and time than the ordinary incision, or the method of overlapping to be described, it is used

almost exclusively by the best operators in clean cases and by a great number in abscess cases as well.

Lewis A. Stimson's laparotomy incision for the prevention of hernia comes within the same class as the McBurney operation, since it is a method of suture by layers with the lines of incision crossing in different tiers of tissue, and pursuing in a general way the natural direction of their fibres. The incision is nearly hemispherical with its convexity downward, beginning about an inch above the symphysis; it is carried upward on either side towards the anterior superior spine, the length of the incision varying directly as the thickness of the wall, through the aponeurotic covering of the rectus, and, outside this muscle, through the aponeurosis of the external oblique. A flap of aponeurosis and integument is dissected from the rectus and turned up on the belly, and below the incision the aponeurosis is freed to a slight extent also. The recti are then separated, and the peritoneum is opened by a vertical incision in the middle line. In closing, the peritoneal line of sutures crosses the line of sutures in the tiers above, and we find in this procedure the analogue of the McBurney operation in its anatomical method and clinical results. No evidence of hernia has arisen in over fifty cases done by Stimson after his plan.

Brief mention might be made here of the silver-wire netting or filigree used so ingeniously by Phelps, Willy Meyer, and recently to good purpose by Bartlett (*ANNALS OF SURGERY*, July, 1903). Such a mode of support has of course no natural anatomical basis, and but limited surgical application, though of undoubted value in those exceptional cases in which it is unfortunately appropriate. It does not appear to be appropriate as a routine treatment of herniæ, since, acting as a foreign body, the silver wire tends to set up suppuration and sinus-formation, which weaken the wound and defeat the very object for which the wire netting is used. The indication for the netting is to reinforce the abdominal wall in cases where, owing to thinning out of stretched structures entering into hernial orifices, or to removal of diseased tissue, normal approximation of the abdominal wall cannot be secured. Some-

what similar comments in regard to their general application might be made of the McBurney and Stimson operations, though having a much wider sphere than the foregoing. Both are admirable in their place, but this is limited to the sites in which these operations are done, and both are restricted to the prevention of hernia.

I have emphasized the fact that the aponeuroses are the structures of essential importance in the operative prevention and cure of hernia of the abdominal wall, and therefore any method which has for its basis not only careful approximation of these parts, but the actual doubling of the strength of the wall by overlapping of the aponeuroses, must be anatomically most perfect. As examples of such procedures we have the operations of Lucas Championnière and Halstead for the cure of inguinal and that of Mayo for umbilical hernia. The first steps of the Championnière operation are the same as regards incision, treatment of the sac, etc., as in the Bassini operation; but in closing the wound, overlapping is secured by drawing the lower flap, consisting of the aponeurosis of the external oblique, up and under the upper flap by means of mattress sutures and bringing down the upper flap over the lower flap and stitching it to Poupart's ligament. The upper flap consists of the internal oblique, the aponeurosis of the external oblique, and, in the lowest angle of the wound, the conjoined tendon and the margin of the rectus. The cord is so displaced that it lies above the external oblique and under the skin. Championnière's record was recently reported to be 868 operations, with thirty-eight relapses (4.3 per cent.) and no deaths. This is better than the average results of the Bassini operation (about 5 per cent. of relapses).

Halstead practises a similar overlapping of the aponeurosis of the external oblique in his improved and perfected operation for inguinal hernia. After the internal oblique has been drawn down and stitched to Poupart's ligament, the external oblique is overlapped by inserting mattress sutures near the edge of the lower flap of the aponeurosis and carrying the sutures through the upper flap from behind and an inch or so

from its free border, and by means of these sutures drawing the lower flap of aponeurosis up under the upper flap and tying them on its surface. The free margin of the upper flap is then brought down over the lower flap and stitched to Poupart's ligament. The cord is not transplanted, but lies beneath the cremaster muscle, which is overlapped by the internal oblique, while the latter is covered by the overlapped aponeurosis of the external oblique, a double doubling of the layers. Results speak louder than words. Halstead has had no recurrences following his operation for inguinal hernia in over ten consecutive years. (For description and excellent plates of this operation, see *Johns Hopkins Bulletin*, August, 1903.)

Mayo's operation for the cure of umbilical hernia consists in surrounding the hernial protrusion by two horizontally elliptical incisions carried down to the aponeurosis of the external oblique, baring this for an area of two and one-half to three inches in all directions about the neck of the sac; excising the sac and omentum; returning the bowel after separating adhesions; widening the ring by transverse cuts extending for an inch on either side of the ring; and, finally, overlapping of the aponeurotic margins of the ring from above downward for some two inches. The lower aponeurotic margin of the ring is drawn up under the upper aponeurotic margin by mattress sutures of silk after the peritoneum has been dissected from the upper lip and approximated to the peritoneal edge of the lower lip. Anatomically, this operation doubles the strength of the strongest structure of the abdominal wall; it avoids the necessity of tension, in approximating the borders of the ring, which has heretofore made the operation for umbilical hernia a byword and reproach in the way of mortality; and, finally, by this mode of closure, intra-abdominal pressure only tightens the hernial aperture by exerting force usually in a horizontal direction. This follows because the typical belly of umbilical hernia is long and pendulous in the vertical direction, and because intra-abdominal pressure acts along horizontal lines, as may be seen in the stretching of scars in the transverse and not in the vertical direction of the belly. Occa-

sionally, however, in umbilical hernia, it is only feasible to overlap the aponeurosis from side to side in those exceptional cases where the long axis of the elliptical opening forming the hernial ring is vertical and not horizontal. In a recent personal operation such was the condition and mode of closure, it being impossible to overlap in the vertical direction.

Mayo's paper at the last annual meeting of the American Medical Association (*Journal of the American Medical Association*, July 25, 1903) fully described and illustrated the operation, and reported thirty-five cases of umbilical hernia operated on by overlapping of the aponeurotic margins of the ring, with only one partial relapse and no deaths. Over against this remarkable record we may put the results of operations by former methods in the hands of the best operators with 50 to 75 per cent. of relapses in the case of large umbilical herniæ, and with a mortality of 50 per cent in strangulated cases. Busse writes of twenty-two cases of operations for umbilical hernia performed during the five years prior to 1901. The mortality was 10 per cent. in all, 25 per cent. in the incarcerated cases, and suppuration in none. He gives the following summary of fifteen of these cases, whose after-history was traced. 1. That 75 per cent. of the large herniæ relapsed (from a double fist to a man's head in size). 2. That 50 per cent. of the medium-sized herniæ relapsed (from the size of a small apple to a goose-egg). 3. That among the cases having small herniæ there were no relapses (from the size of a hazel-nut to that of a walnut). Coley, in presenting and commenting upon this paper ("Progressive Medicine," June, 1903), remarks, "These figures demonstrate the great importance of early radical operation; it being evident that the chances of a permanent cure decreased with the size of the hernia. Busse states that it is only in small umbilical herniæ that a definite cure can be guaranteed. This is the opinion that Dr. Bull and myself have long held." However, Dr. Coley, in a recent letter to me, shows a more hopeful spirit in view of Mayo's wonderful success.

Another mode of overlapping has been independently

practised by Blake, Piccolo, and Sapiejko. This is done in the neighborhood of the umbilicus by overlapping the opposing margins of the recti with their aponeurotic coverings for the cure of hernia in this region. The superfluous skin, umbilicus, and sac are removed by two vertical, elliptical incisions, after treating the hernial contents as seems proper. The aponeurosis over the recti is cleared of fat for the space of a few inches about the hernial orifice, and the peritoneum is dissected away from the borders of the recti and united by suture; or, if this is impossible, the muscles may be overlapped with their peritoneal coat intact. The hernial opening is slit upward and downward in the middle line as far as, but not through, the peritoneum, so as to make it vertically elliptical. Mattress sutures are then passed through the margins of the underlapping muscle and brought out at a suitable distance from the margin of the overlapping muscle, pulled tightly and tied. The edge of the overlapping muscle is tacked down to the aponeurosis of its fellow as in Mayo's operation. This procedure would not be safe or possible in many cases where one has not only to return a large mass of bowel into an abdominal cavity unused to contain it, but must at the same time lessen its capacity. It is as if a man wearing a skin-tight, single-breasted vest should eat an enormous meal, and then be compelled to wear it as a double-breasted garment. Then, unlike the operations of McBurney and Mayo, the action of the recti muscles tends to draw the muscles asunder in this method of approximation. In certain appropriate cases, where transverse laxity of the abdominal wall will permit of the operation, its success warrants its use.

When we see how wonderfully successful have been the special operations of Halstead, Mayo, and Championnière by the method of overlapping the aponeurosis for the cure of hernia, why should we not apply the same principle to the closure of *all abdominal incisions* for the *prevention* of hernia? For instance, I believe that the incision for appendectomy is more properly closed by this method than by any other. It is more easily and quickly done, is more appropriate in afford-

ing the greatest amount of room in diffuse abscess, and will be found to give as good results as the more difficult McBurney operation. Incisions for attacking the gall-bladder and ducts, the common middle-line incision, and incisions in any part of the belly wall can be closed to best advantage in consonance with anatomical reasoning and clinical results by this method. I desire to call particular attention to the fact that overlapping of the aponeurosis has the widest kind of applicability in abdominal surgery.

There is scarcely any abdominal incision which cannot be closed most successfully by this means to avoid hernia. Dr. C. H. Mayo, of Minnesota, writes me, "The overlapping method you mention for hernia and appendix operations we use constantly, and like it very much." In hernia with separation of the recti, and in epigastric and all ventral herniæ, it is *the* operation par excellence.

It has been the object of this paper to study the anatomy of the supporting structures of the abdomen and the various modes of approximating these structures in the closure of abdominal incisions in order to prevent or cure hernia of the belly wall. As a result of our study, we may formulate the following conclusions:

First. That the aponeurotic coverings are the chief supporting structures of the abdominal wall.

Second. That their approximation by overlapping, in doubling the strength of the aponeurotic layers, doubles the strength of the abdominal incision.

Third. That this being so, and the overlapping method being proved the best mode of curing abdominal hernia, it follows that, as prevention is better than cure, it is wiser to *prevent* hernia by employing this principle in closing all abdominal incisions than to be forced to use it later to cure post-operative hernia.

The following is a description of the technique employed for the prevention of abdominal herniæ by overlapping the aponeurosis. This applies to the closure of incisions made in the middle line or for attacking appendix, gall-bladder, etc.

FIG. 5.

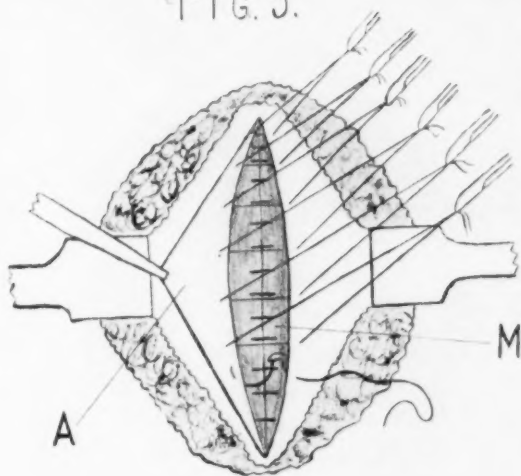


FIG. 6.

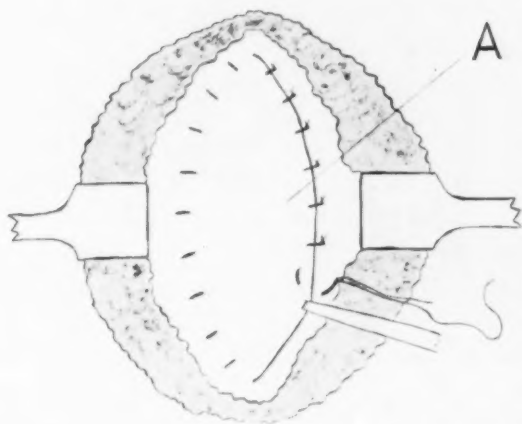


FIG. 5.—Showing type of operation for closing an abdominal incision by overlapping of aponeurosis. First step: muscle coated by interrupted sutures. (A) Flap of aponeurosis lifted from muscle (M); interrupted stitches have been introduced through opposing (right) margin of the aponeurosis and, having been carried over the surface of the muscle, are brought through a portion of the base of the raised flap (A). (This is depicted by needle in illustration, and the ends of the sutures are held by haemostatic forceps ready for tying.)

FIG. 6.—Same, showing second step. The first row of sutures shown in Fig. 5 has been tied, thus approximating the right cut-margin of the aponeurosis to the base of the aponeurotic flap (A). Then flap (A) is brought over the surface of the aponeurosis and its cut-margin attached to this structure by interrupted sutures forming the overlap (portrayed by needle in position). Fig. 4 illustrates same in cross-section.

The integument and subcutaneous tissue are incised down to the aponeurosis. The aponeurosis is bared by reflecting back the skin and fat for a space of an inch and a half on each side of the incision. The aponeurosis is next incised in the same line and directly beneath the skin incision, and two flaps, one on each side of the incision, are raised from the underlying muscle by blunt dissection. One flap of aponeurosis is freed for an inch or so from its cut margin; the other for about half that distance. The incision through the rest of the abdominal wall is completed as usual. In closing, the peritoneum is approximated by a continuous suture. It may be wise in weak, fatty walls to now introduce two or three retention sutures placed well back from the margins of the wound and penetrating all layers above the peritoneum. The muscle, if well developed, is coapted by interrupted sutures. Then the cut edge of the aponeurotic flap, which was but slightly freed, is stitched to the base of the opposing flap (Figs. 5 and 6) by interrupted or mattress sutures. The free margin of the opposing flap is lapped over the other one and stitched down to the surface of the aponeurosis by interrupted or continuous suture. A drain of gauze wrapped about with rubber tissue, or a roll of rubber tissue alone, leading from the lower angle of the wound, should be inserted between the fat and aponeurotic layer in cases where there has been much manipulation or where the adipose tissue is thick. The skin may be coapted with the Michel clamp, buried silver wire, or other suture. The retention sutures are of silkworm gut; medium catgut is used for the lower layers, plain in the case of the peritoneum, chromicized for the muscle and aponeurosis. The retention sutures, if used, are employed merely to support the wall until the dangers of vomiting and meteorism are passed and union has begun.

FIBRINOUS VESICAL CONCRETIONS.

REPORT OF A CASE IN WHICH TWO LARGE FIBRINOUS CONCRETIONS WERE
REMOVED FROM THE URINARY BLADDER.

BY JOHN WHELOCK ELLIOT, M.D.,

OF BOSTON, MASS.,

Surgeon to the Massachusetts General Hospital.

THE following case, so far as I know, is unique.

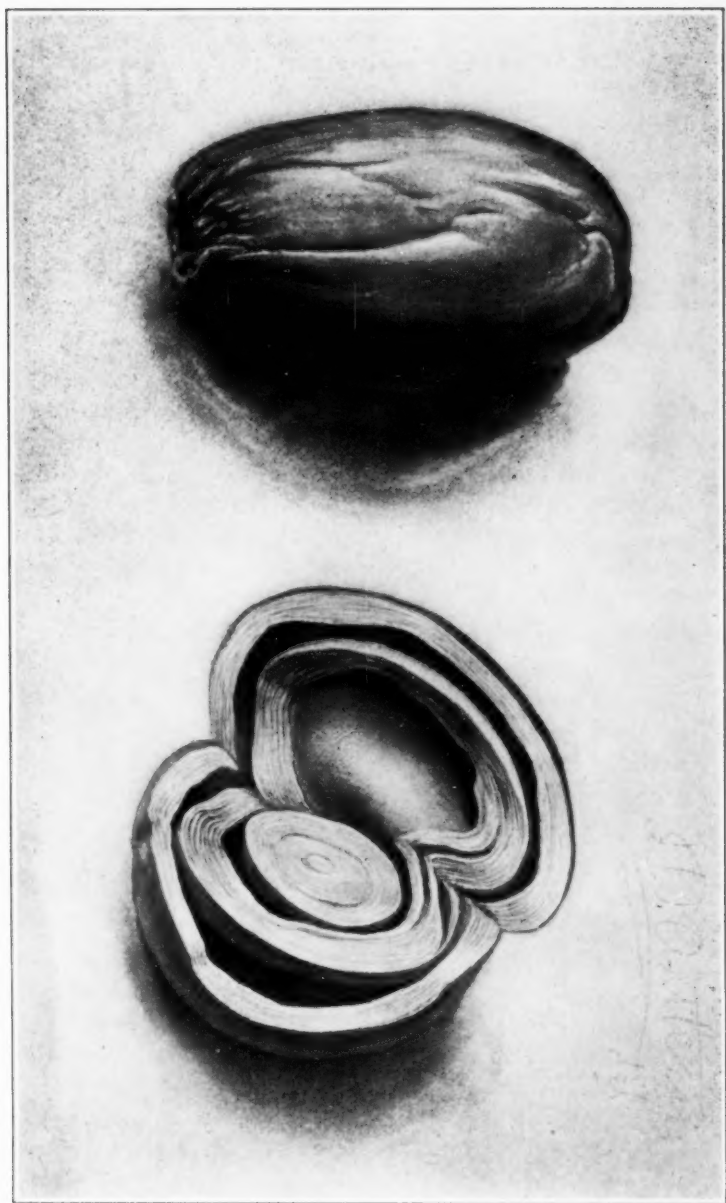
The patient, Mr. F., fifty-four years of age, single, fish-dealer, was admitted on November 3, 1902, to Dr. J. C. Warren's service, at the Massachusetts General Hospital, with the following history.

Six years before entrance he had been seized with severe pain in the abdomen, rolled on the floor, and vomited. This pain lasted for two days, confining him to bed for a week. Since then has had several attacks of a similar nature. During the attacks his urine was very bloody. Three years ago he passed a small stone. In September, 1902, he had four attacks with severe vomiting, the last one ten days before entrance. Pain starts in the left flank and goes down into the groin, at times as far as the testicle; passes water every half-hour. Examination negative. No stone could be felt with the searcher. X-ray and urinary examination negative. While in the wards he passed a small stone per urethra.

Dr. Warren operated for right inguinal hernia, from which operation he made an uninterrupted convalescence.

Patient re-entered the hospital on February 18, 1903, in Dr. Elliot's service. Since discharge has had more or less trouble with his water, at times the urine is bloody, with severe tearing pain, lasting for about ten minutes, and coming on at the time of micturition. Occasionally the urine shuts off abruptly. Micturition is greatly increased in frequency. Six days before entrance he passed bright red urine with clots. Examination by Dr. Elliot with finger in the rectum showed a slightly enlarged prostate, which was tender.

On the 19th, operation by Dr. Elliot. Stone searcher introduced into bladder, but nothing found. Bladder washed with



FIGS. 1 and 2.—Fibrinous concretions about a calcic phosphate nucleus. From Mueller.

Bigelow evacuator. No clicking. On introducing two fingers into the rectum, a mass at the base of the bladder could be plainly felt by bimanual palpation. A suprapubic operation was done after the bladder had been filled with water. The bladder wall was found to be extremely thin. On opening it and inserting the finger, two large, ovoid, smooth, soft masses could be felt about the size of small hen's eggs. These two masses moved freely and were found to be free in the bladder. They were elastic to the feel. After introducing a retractor, both of them were removed with ease. The bladder was otherwise normal. A rubber tube with gauze packing was inserted into the bladder, and a catheter through the urethra. Convalescence uneventful. On section of one of these ovoid masses, a small stone was found in the centre, surrounded by layers of laminated fibrin. (Figs. 1 and 2.)

Drainage tube removed from the bladder on the fourth day. Catheter removed on fourteenth day. Discharged, March 22. May 18, feels perfectly well; has no frequency of micturition.

The following is the pathological report by Dr. Whitney on the specimens removed.

Two egg-shaped bodies removed from the bladder, the larger measured 6.5 by 3.75 centimetres and the other 5.5 by 3.5 centimetres. They were of a lightish yellow color, with smooth surfaces, slightly wrinkled, and of the consistency of firm putty. The larger weighed forty-five grammes and the smaller twenty-seven grammes.

On section the structure was found to be laminated, between some of the layers of which were spaces which may have been occupied by fluid.

The structure was homogeneous, slightly gritty, giving the impression of coagulated material, fibrin and mucus, mixed with particles of urinary salts, in the centre of which was a small nucleus which measured about 2.5 centimetres in greatest extent, composed of inorganic material, which on the analysis of Professor E. S. Wood was found to be composed "chiefly of calcic phosphate, with trace of calcic carbonate and triple phosphate, and débris of inorganic material."

Fibrinous concretion about a calcic phosphate nucleus.

PARTIAL ENTEROCELE.¹

BY LUCIUS W. HOTCHKISS, M.D.,

OF NEW YORK CITY,

Surgeon to the J. Hood Wright Hospital; Assistant Surgeon to Bellevue Hospital.

PARTIAL enterocele, or hernia in which only a portion of the gut wall is pushed into the hernial sac, is as interesting as it is rare.

Its mode of production is still a matter of dispute, as the condition must be clearly distinguished from the true intestinal diverticula. Whether these cases sometimes begin from a pre-formed false diverticulum, or always acutely as an accidental strangulation of some portion of the wall of the small intestine, is still a mooted question, and one mainly of academic interest.

To the surgeon it presents itself as a form of strangulated hernia, most dangerous because of the lack of typical symptoms. The hernial sac in these cases is generally small, its contents a portion of intestinal wall, and omentum very exceptionally. With dense and unyielding walls and a narrow aperture in which the partial enterocele is caught, the strangulated portion of the gut wall soon loses its vitality, and gangrene, perforation, and general peritonitis even, may ensue, before the case assumes clinically the appearance of real gravity.

In some of the reported cases a pre-existing hernia has been present, but in the majority it is very small or entirely unnoticed, until, after some unusual strain perhaps, a small swelling develops at the site of one of the hernial openings, and becomes painful. From the fact that only a portion of the intestinal wall is engaged in the neck of the sac, the typical signs of acute intestinal obstruction, so early developed in ordinary cases of strangulated hernia, may not appear until late, or until the inflammation with its accompanying swelling has spread to and involved the unstrangulated portion and led to its complete occlusion.

¹ Read before the New York Surgical Society, October 14, 1903.

The portion of intestinal wall involved in partial enterocele is generally the convexity opposite the mesenteric attachment. The lateral wall, however, may be the seat of strangulation, simulating a true diverticulum, or even the mesenteric border of the gut may be implicated.

When such a hernia does occur, it must be evident, from its very nature, that the interference with the circulation in the involved portion of the gut must soon be followed by swelling and infiltration of its tissues, by the outwandering of the intestinal bacteria through the damaged gut wall, and a general infection of the sac and contents. Adhesions between the gut and the neck of the sac protect the general peritoneum from infection for a little time, but finally this feeble barrier is overcome and a general peritonitis rapidly develops. This course of events is admirably illustrated in one of the cases to be reported.

Since the conditions in strangulated partial enterocele are such that considerable damage to the intestinal wall is bound to have occurred before the diagnosis is made or an operation undertaken, resection of the gut will of necessity have to be resorted to in most of the cases as an essential part of the treatment. The following cases drawn mostly from the records of the J. Hood Wright Hospital serve to illustrate some interesting points in connection with the diagnosis and treatment of this rather unusual and very dangerous form of hernia.

CASE I.—*Strangulated Inguinal Hernia (Partial Enterocele); General Peritonitis.*

W. H.; twenty-two years; January 10, 1898. Seen in consultation with Dr. J. A. Jenkins; four days ago seized with acute abdominal pain and vomiting; pain became more severe and constipation absolute. Seen by Dr. Jenkins thirty-six hours later; cathartics given without result; pain and vomiting continued; distention of the abdomen developed and his condition became steadily worse.

Examination.—Patient looked very ill; face pinched and drawn; pulse rapid; temperature, 101° F.; abdomen distended and markedly tender over the right side. Right rectus tense.

Examination of inguinal canal on right side revealed what seemed to be an enlarged and tender cord. Patient had a hernia twelve years before, which was supposedly cured.

His physician regarded the case as one of obstruction. In view of the temperature, tenderness, and apparent peritonitis, a diagnosis of appendicitis with peritonitis and obstruction from paresis of gut was made. Immediate operation. Under ether narcosis, marked right-sided abdominal rigidity was apparent, and an elongated mass was felt low down in the right inguinal region. An oblique right-sided incision was made over mass and the peritoneum opened. There was considerable free serum in the abdominal cavity, the intestinal coils were congested and distended, and in separating them to search for the appendix a loop of gut was found apparently adherent to the right internal abdominal ring. This was freed easily and found to be a strangulated partial enterocele. Intestines washed with saline solution after partial evisceration, and the damaged loop of gut, in view of the patient's bad condition, was not resected, but packed off with gauze and left in the bottom of the wound. Dressing changed next day. A very free oozing of serum had taken place. Condition growing worse. Temperature, 103° F. Peritonitis progressed and patient died the following day.

CASE II.—*Strangulated Inguinal Hernia (Right Partial Enterocele); Gangrene of Gut; Resection; Murphy's Button; Pneumonia; Thrombosis of Left Saphenous Vein; Recovery.*

H. S.; nineteen years; admitted to hospital January 4, 1899, at 4.05 A.M. by ambulance. Noticed a small incomplete right hernia one year ago. Has been subject to cramp-like pain in bowels. The day before admission, he began to have abdominal pain, nausea, and vomiting, and noticed a swelling at the site of the right inguinal ring. Bowels moved yesterday A.M. Vomited three times before admission. On admission he complained of epigastric pain, and has had no movement for twenty-four hours. Enema brings away fluid but no gas. Legs drawn up and looks sick. Examination reveals small tumor filling the upper part of the right inguinal canal and coming down to the upper end of scrotum. This swelling is tense but not tender, and there is distinct impulse on coughing. There is marked tenderness at the site of the right internal abdominal ring, but not elsewhere. There is no abdominal distention.

A hot bath was given and moderate taxis made, but unsuccessfully. Rectal tube brought away some gas. Operation, 4 P.M., January 4, 1899. Ether. Oblique inguinal incision. Small hernial sac found in the upper end of scrotum; this was incised and a small amount of brownish fluid with slight odor evacuated. In the upper end of this sac there was a small knuckle of gut firmly grasped and lightly adherent. Division of the constriction allowed the gut to be pulled down and a typical Richter's hernia demonstrated. A small portion of the wall of the small intestine had been pushed into the internal ring and become strangulated. This area was dusky and surrounded by a well-marked ring of necrotic tissue, which was separated from the rest of the healthy wall of the gut. The mesenteric vessels leading from it were thrombosed, and there was no evidence of vitality after washing in warm saline solution. The site of the hernia, with about four inches of gut, was therefore resected and the gut's ends united by the Murphy button. Sac tied off and Bassini's operation done. Patient made a good recovery from the operation, and the condition of the wound at the dressing next day was satisfactory. On the sixth day of January, two days after the operation, a right lower pneumonia developed, and on the same day a large tapeworm was passed. Ninth of January wound was dressed, slight faecal odor from the discharge. Wound opened and a wet dressing applied. Sixteenth of January Murphy button passed. Twenty-fourth of January wound granulating, secondary sutures and strips. Twenty-eighth of January thrombosis of the left internal saphenous vein developed, with pain and swelling of the lower extremity involved. This condition cleared up in a few days, however, and the patient made a good recovery, being discharged as cured March 12, 1899.

CASE III.—*Strangulated Partial Enterocele; Operation; Reduction; General Peritonitis; Secondary Operation; Death.*

A. A.; thirty-five years; admitted to hospital service of Dr. Le Boutillier, October 13, 1902, with the following history: Has had a left inguinal hernia for three years, had not worn a truss nor had any trouble until ten days before, when he was seized with severe pain in the region about the umbilicus and began to vomit, which vomiting has continued, and lately has developed a faecal odor. Bowels have moved once in this time. Examination on admission, patient looked very ill; face drawn and

anxious; pulse weak; tongue dry and brown. Abdomen somewhat distended, and patient complains of pain about the umbilical region, where there is also some tenderness. There is also some general abdominal tenderness. At the site of the left internal abdominal ring there is a small, painful, irreducible swelling, which gives no impulse on coughing. Temperature, 99° F.; pulse, 96; respiration, 20; urine, negative. Immediate operation by Dr. Campbell, the House Surgeon, under instructions of Dr. Le Bourtillier, attending surgeon. The stomach having been washed out, gas and ether were given, and an oblique incision made over the left inguinal canal; a small, tense, and rather thick hernial sac was found, from which, on being opened, a small amount of dark-colored fluid with slight odor was evacuated; five inches of omentum, also dark-colored, and a small knuckle of dark-colored gut slightly constricted at the neck of the sac was found. On incising the point of constriction at the neck of the sac, it was found that only a portion of the wall of the gut had been strangulated. This portion was black, but, as its color returned somewhat under hot saline solution irrigation, it was reduced. The omentum was ligated and excised, and the sac having been tied off the operation was completed as a typical Bassini's. After the operation faecal vomiting occurred, but the next day the condition had much improved; there was a good result from an enema, and no vomiting. The patient steadily improved up to the 16th, when the temperature rose to 102° F. and the pulse to 120; but there was no general tenderness or distention. On the 18th distention and tenderness were evident, and about noon vomiting began and distention became more pronounced. Gas and some faecal matter in response to enema; as condition did not improve at 6 P.M., the belly was opened, and incision of the peritoneum followed by escape of gas and faeces. Saline irrigation of peritoneum. Temperature rose to 107° F. Died at 1 P.M., 19th.

CASE IV.—*Strangulated Inguinal Hernia; Partial Enterocoele; Gangrene of Gut; Perforation; Resection; End-to-End Anastomosis by Maunsell's Method; Died.*

P. F.; forty-eight years; admitted to hospital January 28, 1897; walked in. He has had a reducible hernia since boyhood, and it had never troubled him up to ten years ago, when for a time it became irreducible. After this he wore a truss, which had held it up well until three days before, when it grew larger, and

was no longer retained by the truss, and became irreducible. Vomiting and some pain ensued, but the bowels moved the next day, though not since. Vomiting has continued, but is not very frequent. Examination by the House Surgeon, who found what seemed to be an inflamed irreducible hernia. Sac not tense nor especially tender. Temperature, 101.6° F.; pulse, 100; urine, negative. Put to bed, ice-bag applied locally. During the night some hiccough and felt weak. Next day, enema effectual, temperature falling. January 30, A.M., temperature normal, looks very badly. Operation, 2.30 P.M. Ether.

Usual incision was made over the hernial sac, which was not tense, and the sac was opened. Brownish faecal-smelling fluid evacuated. A small knuckle of gut firmly grasped in the upper end of sac, was gangrenous, and showed a small perforation. Sac washed out, gut released, strangulated area resected, and ends joined by Maunsell's method of anastomosis, after an unsuccessful attempt with the Murphy button on account of the difference in size and thickness of the proximal and distal ends of the gut. Wound closed by Bassini's method, with drainage at angles on account of the faecal contents of the sac. After operation, temperature rose, but there was no complaint of pain or tenderness over abdomen, which became much distended. February 1, temperature rose to 104° F., distention increased, and the patient died. A partial autopsy revealed a water-tight anastomosis, but gangrenous edges of the opposed segments and a spot of gangrene about four inches proximal to the junction. Too much gut had been turned in by suture and the opening at the point of anastomosis was small.

CASE V.—*Strangulated Right Inguinal Hernia (Partial Enterocele); Resection; Murphy Button; Recovery.*

W. H.; sixty-four years; admitted February 9, 1903; walked in. Three years ago noticed rupture, and procured a truss which held it up well. Two days ago was seized with pain in the right inguinal region, and noticed some swelling in this situation. The pain has been severe, but no nausea or vomiting.

Examination.—Just above the right external abdominal ring within the canal there is a small swelling which feels like a cyst, tense, smooth, no impulse on coughing, flat on percussion, not especially tender. Diagnosis not made.

Operation same day. Oblique inguinal incision over mass

revealed a small sac which contained about two drachms of dark-colored fluid, and at the neck there protruded a small, tense, rounded tumor, which proved to be a portion of the wall of the small gut which had become strangulated. The area involved was clearly gangrenous, so the gut was resected and the ends joined by Murphy button in the usual manner. The convalescence was uninterrupted, the patient being fed with great care. There was a very moderate wound infection which was soon over, and the patient was discharged as cured March 8, 1903.

CASE VI.—*Strangulated Littre's Hernia; Gangrene; Resection of Gut; Anastomosis by the Murphy Button; Recovery.*

W. H.; sixty-four years; admitted to hospital February 9, 1903. Previous history:—Right-sided inguinal hernia, noticed ten years ago, but never gave any trouble and always well held up by truss. Ten days ago was seized with sudden pain in the right inguinal region and noticed a swelling there. No nausea or vomiting; bowels have been constipated, but were moved since admission. Examination shows a lean old man in fairly good condition. Heart and lungs negative; arteries slightly thickened. At the right external inguinal ring there is a swelling about the size of a walnut,—tense, smooth, irreducible, flat on percussion; no impulse on coughing. Temperature, 100.2° F.; pulse, 72; respiration, 22. Case seen by writer next day, as it was not considered urgent by members of staff who examined it.

Operation.—Dr. Hotchkiss, February 10, 1903; gas and ether. Usual incision; small sac, dark fluid, and a portion of wall of small intestine protruding into and strangulated by neck. As strangulated portion was gangrenous, gut was resected and ends united by the Murphy button. Uneventful recovery. Discharged as cured, March 3, 1903. The button passed several days later.

In reviewing these six cases, the writer is struck by the lack of uniformity in the symptoms, the absence of any single pathognomonic sign which would have made an early diagnosis reasonably certain, and, finally, by the great disproportion between the severity of the earlier symptoms and the real gravity of the case.

PERFORATION OF THE URINARY BLADDER BY AN APPENDICEAL ABSCESS.

BY I. S. STONE, M.D.,

OF WASHINGTON, D. C.

Mrs. T., aged fifty years, had the usual symptoms of appendicitis early in August, 1903. Her condition, in her physician's opinion, was not such as to demand early operation, and she remained in her bed for several weeks at her home in a small country town during her critical illness. An abscess developed in the right iliac fossa which caused the usual pain with fever. Her bowels were not apparently influenced by the presence of the abscess, nor were the symptoms of peritonitis present.

After three weeks' illness the patient had dysuria and other signs of cystitis, which finally culminated in a discharge of nearly a pint of pus (during two days) from the bladder. The pain diminished, the fever subsided, and the swelling in the ovarian region began rapidly to disappear. The patient was brought to us, October 24, for examination. Her condition had greatly improved. There was only slight rise of temperature and pulse, and her only complaint was "irritable bladder" and slight tenderness on pressure in the right inguinal region. A mass could be located which showed the site of the former abscess, and we suggested appendectomy in order to prevent future trouble.

When the abdomen was opened, we found the appendix with a rather fat mesentery adherent over the right upper cornu of the bladder, and stretching across the right side of the pelvis above the Fallopian tube and broad ligament. There were no adhesions between peritoneal surfaces except at the point where the appendix and omentum were attached to the pelvic wall as above described. The omentum was evidently of great service in securing the attachment of the appendix to the parietes. When the appendix was liberated and removed, its distal extremity was found open and in direct contact with the perivesical cellular tissue immediately over the bladder. The bladder was filled with an aqueous solution of methylene blue and was found intact, showing that spontaneous closure had been made. A drainage tube was

placed outside the peritoneum connecting the infected cellular tissue over the bladder with an incision near the anterior superior spine of the ilium.

The patient promptly recovered, and was ready to leave the hospital in two weeks.

We have collected reports of over thirty similar cases by as many surgeons, and append the names to this paper for reference.

1. Fraser, Maritime Medical News, Halifax, Vol. xv, No. 4, April, 1903.
2. Fowler, G. R. Medical News, New York, May 21, 1898.
3. Keen, W. W. Journal of American Medical Association, 1898, p. 1108.
Also American Surgical Association, 1898.
4. Vanderveer, A. Transactions of American Surgical Association, 1899, xvii, 199, Philadelphia.
5. Stedman, C. E. Boston Medical and Surgical Journal, September 6, 1888, 241.
6. Bulkley, L. D. Montreal Medical Journal (quoted by Costen, also in Universal Annual of Medical Science).
7. Coston, H. R. Memphis Medical Monthly, 1901, Vol. xxi.
8. Allen, Percy. British Medical Journal, November 17, 1900, p. 1432.
9. Deaver, J. B. Journal of American Medical Association, 1901, p. 27.
10. Reynes, H. Les Complications Vésicales de la Appendicite, Cong. Internat. de Méd. Cr., Paris, 1900, Sect. de Chirurg. Gen., 685-693.
11. Duret, H. (De Lille). Des Troubles Urinaires dans les Appendicite, L'Assn. Française d'Urologie Prac. Verbaux et Mem., 1889, 4.
12. Lafforge, C. Jour. de Anatomie.
13. Gerster, Krackoiviser (Medical Record, 1867), Schwartz.
14. Trommer, I. Sulyos Appendicites, Perforational, Budapest, 1901, xli, 602, 604.
15. Vladoff. Thesis, Lyon, Tome xvii, 1897-98, Des Absces Appendiculaire, ouverts dans la Vesie, mentions cases by:
16. Roux (Lausanne). Méd. de la Suisse.
17. Brun. La Presse Médicale, July, 1896, p. 341.
18. Poncet. (Reported by Brian and Geroud.)
19. Menère. Arch. de Méd., 1828, p. 527.
20. Leplat. (See Vladoff.)
21. Bulzer. Gaz. Méd., No. 25, p. 321.
22. Halle. Ann. des Surg. Genito-Urinaires, 1892, p. 916. Recovered.
Also, Halle, Ann. des Surg. Genito-Urinaires, 1892, p. 913. Died.
23. Dauce et Husson Répertoire d'Anatomie, T. iv, 1827, Obs. 17.
24. Boiffin. Bull. Soc. de Chirurg. (year not named), p. 308. (Both rectum and bladder.)
25. Sedillott. Ann. de Chirurg., 1841, p. 305. (Intest. and bladder fist.)
Death.

26. Jackson, James. *Gazette Médicale*, 1837, p. 123. (Appendiceal abscess, perforated bladder.) Autopsy.
27. Roux. Lausanne.
28. Poncet.
29. Jarville.
30. Gangolphe.
31. Rochester, Thomas F. Case of Perforation of the Bladder by an Appendiceal Abscess. *Trans. Amer. Med. Assn.*, Vol. xxx, 1879, p. 495. (Fatal.)

OTHER REPORTERS ARE:

- Therig. Durchbruch in die harnblase. *Cent. für Innere Medicin*. Zwei Falle von Paratyphlitis, Leipzig, 1894, xv, 97-99.
- Oesterlen. Ueber den Durchbruch perityphlitischer abscesse in die Blase, und die andern hohlorgans des Beckens, Berlin (Thesis), 1896.
- Damien-Masson. *Étude des complications vésicales dans appendicite*, Paris. Thesis. Presented November 4, 1898.
- Musham, R. Mittheilungen aus den Grenzgebieten der Medicin und Chirurgie. Jena, 1903, Band xi, p. 287.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, October 28, 1903.

The President, LUCIUS W. HOTCHKISS, M.D., in the Chair.

APPENDICOSTOMY, FOR CHRONIC ULCERATIVE COLITIS, ONE YEAR AFTER OPERATION.

DR. WILLY MEYER thought the members of the Society might be interested in seeing again the patient whom he had shown at the May meeting. The patient was a woman, fifty-four years old, who had had thin bloody stools for over two years before she entered the hospital. According to her history, a diagnosis of dysenteric ulcers was made, although the clinical symptoms also pointed to a specific cause. Upon entering the hospital she was very much reduced in strength, and the electric illumination of the rectum revealed the presence of ulcers throughout this organ; bleeding surfaces were also seen high up at the turn of the rectum. Prior to her admission to the hospital she had been treated at home with irrigations, but without improvement. It was decided to resort to Dr. Weir's method of using the appendix for the introduction of an irrigating tube. Through the appendicostomic opening irrigations were kept up every day, then every other day, now for twelve months; the solutions used were silver nitrate in increasing dose, sometimes thymol, etc. When the patient left the hospital, five months after the operation, she had gained over twenty pounds. At the time of her entering the hospital she only weighed eighty-two pounds. On account of strictures within the lumen of the appendix the reintroduction of the tube at intervals had to be given up. She was advised not to make any further attempts to increase her comfort, but to leave the

tube permanently in place. The irrigations were given with an ordinary fountain syringe and administered every other day. There has been no leakage, and she has continued to gain flesh and strength, now weighing about 110 pounds. The rectoscope showed that the ulcers had healed. The time has come to remove the tube and let the appendicostomy wound close.

APPENDICOSTOMY FOR MULTIPLE PAPILLOMA OF THE COLON.

DR. WILLY MEYER presented a man, twenty-nine years old, who entered the hospital in May, 1902. He had had repeated hæmorrhages from the intestines, and the rectal tube revealed a number of tumors within the rectum, multiple papilloma. A colostomy had been performed on July 10 and 13 according to Schede's method, and on August 20 the rectum was resected with the help of the osteoplastic method of Rehn-Rydygier. September showed the wound slowly closing, but a posterior fistula had become established at the place where the sutures had been. When the speaker took service a number of ulcerations and recurring papillomata were found in the neighborhood of the internal opening of the fistula. The patient asked that the posterior fistula be closed. Four months after the first operation, on December 1, the flap was turned back and the partially necrotic piece of the sacrum with the coccyx removed. The fistula was found at the site of the suture. In order to reach the same, it became necessary to make an additional resection of the sacrum, removing about one-half of an inch of it transversely. Then the fistula could be closed with a double row of chromicized catgut sutures after freshening the edges. So far as the fistula was concerned the patient did better. The discharge was a great deal less, but there was developed retention of urine, which the speaker thought might have been due to some injury to the nerves of the bladder. The patient's general condition gradually improved, although he had to be catheterized. Eight months later he was able to pass his water all right, and to-day he has complete control.

The speaker thought this case illustrated well the wisdom of waiting in such cases before establishing an artificial suprapubic outlet for the urine. There had been some trouble with the arti-

ficial anus, and in 1903 one had attempted to close the fistula at its original site after doing an inguinal colostomy lower down. To-day both the colostomy wound and the fistula still lead into the colon. Repeated attempts at closing the latter had failed. When he came on duty again in the hospital during May, the patient was much reduced and had frequent diarrhoea and hæmorrhages. He proposed an appendicostomy, and on the 3d of June it was performed. The appendix was pulled so far out that the entrance to the cæcum corresponded to the peritoneal wound. The abdominal wound having been closed, the appendix projected about one and a half inches over the skin. It was amputated, and probably a little more retained than was necessary. It was permeable. The next day a catheter was introduced and irrigations commenced, using nitrate of silver and thymol; the patient began to improve at once. The irrigations generally took about fifteen or twenty minutes, and the solution was passed during that time; sometimes, however, a few hours later water was still discharged through the artificial anus. To-day the patient had gained much in weight. The catheter was left out from the start.

In an article published some time ago the speaker ventured to propose appendicostomy in cases of intestinal obstruction due to cancer of the colon or rectum. If the appendix was not found to be obliterated, it certainly was simpler and safer to do appendicostomy than cæcostomy. He had tried to find out in this patient whether water would return through the tube after the colon had been distended. For this purpose the afferent part of the artificial anus was tamponed, and now a large quantity of water allowed to flow in. It was noted that only a small amount of water returned. This was perhaps due to a papilloma obstructing the inner end of the tube. Only observations on cases as mentioned above will clear up this point. Dr. Meyer expressed the opinion that, according to his experience, appendicostomy had a decided place in the field of surgery.

DR. HOWARD LILIENTHAL said he had had three cases of appendicostomy; one had been reported some time ago and was a failure; the other two were successes. In both of these latter cases there had been no difficulty in irrigating with the rectal tube introduced not far and with the catheter in the appendicostomy wound. The fluids used came through promptly. His second

successful case was operated upon by one of his adjunct surgeons. This patient gained twenty pounds in a short time in spite of the fact that there was a nephritis at the time of operation. Both these cases were ulcerative colitis. The unsuccessful case was one of papillomatous colitis; the fluids would not run as they should, and finally a cæcostomy was performed. This patient went from bad to worse and died of asthenia.

He did not believe that in old persons with stricture of the lower bowel such an operation would ever become valuable, especially when the needs of operation and relief were urgent. He believed one took chances in not working quickly, *i.e.*, doing a quick colostomy and relieving the imminent danger. More radical procedures could then be later undertaken.

CHOLECYSTECTOMY.

DR. WILLY MEYER presented a woman, fifty-two years old, who had entered the hospital the middle of last December with symptoms of a first attack of cholecystitis. All the symptoms were but slightly developed, and there seemed to be no reason to fear the existence of any serious trouble. After entering the hospital all clinical symptoms soon subsided except some slight tenderness over the region of the gall-bladder. An operation was advised and performed with a longitudinal incision through the rectum on the 27th of December, when the following conditions were found: The omentum was adherent to the gall-bladder and liver; after stripping it off an abscess was found which contained about an ounce of pus. The speaker was surprised to find underneath the omentum the existence of a pretty far advanced gangrene. Nothing could be done except to extirpate the gall-bladder, which was done in the usual manner. He used silk for tying the cystic duct; now he uses chromicized catgut. The mucous membrane of the removed gall-bladder was found to be diffusely gangrenous. The specimen which he presented showed an artificially inverted, much thickened gall-bladder, with the scattered necrotic patches of the mucosa still visible. One very large stone was found with one facet, and on top of it a smaller stone was found with two distinct facets, one on either side. It was interesting to note that the smaller stone had made a complete somersault within the bladder. This moving of the stone

probably has occurred at the time the gall was flowing into and out of the bladder, allowing the small stone to turn and to rub at one time his one pole on the larger stone, and at another time its other side. There surely had been only two stones in the bladder.

The silk ligature was used on the 27th of December; in the beginning of February, six weeks later, he succeeded in removing the thread. The patient was now perfectly well. No ventral hernia had developed.

DR. GEORGE WOOLSEY reported the case of a woman in the Presbyterian Hospital upon whom he had operated last summer. The symptoms, so far as the tenderness and pain were concerned, were confined to the left side. These symptoms were referred to a point to the left of the median line, about three inches above the level of the umbilicus. There was no pain or tenderness on pressure between the umbilicus and margin of the ribs on the right side. A probable diagnosis of cholelithiasis was made, although there arose the question of disease of the pancreas. The history dated back five or six years, and the symptoms were increasing in severity. The patient had a slight temperature, 101° F., and slight jaundice. An incision was made in the median line and nothing was found on the left side. The gall-bladder was small, and did not project below the margin of the liver. Its layers were thickened and very dark, almost gangrenous, in appearance. The gall-bladder contained many stones, half a dozen of which were quite large ones. He searched for a possible cause of the jaundice, but no stone was found in the common duct; the head of the pancreas was found to be enlarged and hard. The jaundice he attributed to slight obstruction due to pressure of the hard pancreas upon the common duct. The gall-bladder was removed by a simple cholecystectomy, with good results. The jaundice gradually disappeared. The interesting and unusual feature was the tenderness on pressure and pain confined to the left side. The explanation of this was obscure. Whether it was due to adhesions, which presented nothing unusual, to the pancreatitis, or to some other cause, he could not say.

DR. WILLY MEYER said that he too had noticed in several patients who were troubled with a chronic recurring cholecystitis that they complained of tenderness on the left side of the lower abdomen in the acute attacks and of more pain on the left than

on the right side. He believed the general practitioner was sometimes misled in his diagnosis on account of this peculiar condition. He was inclined to explain this peculiar phenomenon as being due to irradiation within the affected sympathetic nervous system.

ESOPHAGEAL STRICTURE DILATED BY A THREAD AND RUBBER TUBE.

DR. CHARLES N. DOWD presented a child of four years who was admitted to St. Mary's Hospital for Children, March 28, 1903, for pneumonia and œsophageal stricture. About February 15 she had swallowed some lye, and had suffered from increasing difficulty in swallowing for the last three weeks. The pneumonia, which was severe, prevented treatment of the œsophageal stricture at first; but by April 6 the pneumonia had fortunately subsided enough to permit a gastrostomy. At this time the child's condition was most pitiable. She was emaciated to the last degree, and was as nearly starved as a child could be and yet live; apparently nothing had passed from the mouth to the stomach for several days, and rectal feeding was a poor substitute for normal feeding during an exhausting illness. It was doubtful whether she could endure anæsthesia and even a mild operation, but fortunately she did, and gastrostomy was done by the purse-string method (Stamm's), and milk was introduced into the stomach while she was still on the operating table. After this she gained very rapidly; there was no leakage from the gastrostomy wound; she consumed large quantities of milk, and gained much in weight and strength.

The stricture still remained, however; no instrument could be passed from above, and repeated efforts to float a silk thread through, as advocated by Dunham, were fruitless. Therefore on May 1 an attempt was made to pass instruments upward through the cardiac orifice of the stomach; the gastrostomy opening was enlarged sufficiently to admit a Kelly's cystoscope tube, one-half inch in diameter, and by means of reflected light the orifice was found, but nothing could be passed. A large blunt-pointed copper probe was tried, then a small blunt-pointed silver probe, then filiforms and various kinds of bougies, but all of them met firm obstruction close to the stomach mucous membrane. In order to test the permeability of the stricture, a little milk was then

passed in from above through a catheter, and after a time a minute drop came through the opening, but the probe failed to pass when applied to this very spot. The child was therefore put back to bed and a second similar attempt was made three days later, but that too failed. No further attempts were made to pass instruments from below, but renewed efforts were made to pass a thread from above by running it through a drinking-tube, holding it so as to prevent too much going in at once, and then waiting for the free end to be carried through the stricture with the feeble flow of the water which worked its way through the stricture. Dr. J. H. Lewis, the house surgeon, was most patient and persistent in this work, and finally, on May 13, succeeded in getting a fine silk thread through from the mouth to the stomach. The dilatation of the stricture was then simply a matter of time and patience; other threads were drawn through on this one, and on May 15 one of them was drawn up and down so as to slightly saw the stricture walls, following Abbe's suggestion (*N. Y. Med. Record*, Feb. 25, 1893), and a piece of rubber tubing about the size of a No. 15 French catheter was stretched out by a thread attached to each end, drawn into the stricture and permitted to remain in place and dilate it by its elasticity, as advocated by Dr. Curtis before this Society (see *ANNALS OF SURGERY*, Vol. xxxi, p. 352). This tube slipped into the stomach, and on May 20 was removed, and an unsuccessful effort was made to pass bougies from the mouth; they only went to a point seven inches from the teeth, however. On May 22 another larger tube was stretched and drawn into the stricture, and four days later this was drawn up through the mouth; but even then bougies could not be passed from above. On May 27 she was able to take milk and soft hominy porridge by the mouth, and the next day she took crackers and bread and milk.

May 29 a No. 15 (F.) bougie was passed upward by inserting its tip in the end of a No. 12 catheter, which was drawn upward on one of the threads. By pursuing this method only a No. 16 bougie could be passed from below, June 11, and none could be passed from above. On that day a No. 19 wire bougie (Dunham) could not be drawn through the stricture. A piece of rubber tubing the size of a 32 French catheter was therefore stretched and drawn into the stricture; on the following day this had slipped into the stomach, and a No. 24 bougie could be

passed from above. The bougies were then passed daily, and by July 17 a No. 28 was passed into the stomach from above. Bougies have been passed since at irregular intervals, and now size No. 26 passes easily into the stomach, and she takes the ordinary kinds of solid food and swallows and digests them well.

There are several points of interest in this case. The most important is the passage of the silk thread through the stricture after the failure of most careful and persistent efforts to pass instruments both from above and below. The stricture occupied the lower three inches of the œsophagus, and was so tight as to hardly have a lumen. When the child took fluid by the mouth, she swallowed a little, and then regurgitated it, throwing up, as nearly as could be measured, all that she had taken; and when the process was observed by introducing milk into the œsophagus through a catheter, and then watching for several minutes at the cardiac orifice through a cystoscope tube with the aid of reflected light, so small an amount of milk trickled through that it could hardly be called a drop. Yet the thread finally found its way through this minute channel, a remarkable illustration of the efficacy of this simple procedure so ably proposed by Dr. Dunham (*ANNALS OF SURGERY*, March, 1903, p. 350). This method is apparently the best that we have for introducing a guide through a very narrow œsophageal stricture. The case, too, illustrates the efficacy of the stretched rubber tube as an œsophageal dilator. It was surprising how easily the tube could be introduced, and how quickly it dilated the stricture when in place. After drawing the thread up and down a few times, the first size, No. 15 French, was easily introduced, and probably fell back into the stomach on the following day. The second size, No. 20 French, was also easily introduced, and was held in place by fastening the string to the cheek; this, however, caused much irritation. The third size, No. 32 French, was also easily introduced, and was only left in place one day, but in that time it dilated the stricture from sixteen to twenty-four, as measured by bougies. No doubt the entire dilatation could have been accomplished within a very few days, or perhaps at a single operation. With this weak child, however, it seemed better to use a more gradual method.

There was enough leaking from the gastrostomy wound to make a troublesome complication in this case. After the enlarge-

ment of this wound for the introduction of the cystoscope tube and passage of instruments, purse-string and interrupted sutures were taken to constrict the opening; but as there were no fresh peritoneal surfaces, they did not prevent leaking entirely, and it hardly seemed wise to expose the peritoneal surfaces anew, since healing was taking place without it. The wound has now been practically healed for weeks, although there is still a very little leaking from a minute opening.

THROMBOSIS OF LATERAL SINUS AND UPPER JUGULAR VEIN.

DR. CHARLES N. DOWD presented a girl of eleven years who had been suffering from a discharge from the left ear for over a year. Six months ago it became worse; for the last month she had suffered from increasing pain, and on September 12, two days before her admission to St. Mary's Hospital, she had a chill. When admitted, there was moderate tenderness over the mastoid, and soon afterwards she had a chill, and her temperature went up to 105.2° F. On the following morning he operated, and found extensive disease of the mastoid. There was considerable pus in the antrum and the bony structure behind and below it. It was an extensive case of suppurative mastoid disease, and a thorough mastoid operation was done, all the pneumatic cells being removed, and drainage established from the tympanum through the antrum. There was one spot of bone over the lateral sinus that looked suspicious, and it was removed; the sinus was inspected and found to be normal in appearance. After the operation the temperature went down, and remained so for one week, all the symptoms being favorable; then it suddenly went up again; the patient had a chill, then another and another, the temperature going to 105° F., and over the upper part of the jugular vein there was some swelling and tenderness.

Another operation was therefore done. On removing the bone from over the lateral sinus much inflammatory exudate was found, and hence, before proceeding further there, an incision was made in the neck and the internal jugular vein was removed from just above the clavicle to a point above the entrance of the facial vein. The vein above this point was shrunk and its lumen obliterated. The longitudinal sinus was then exposed from

the bulb backward for about an inch and a half, and was found to be obliterated throughout this area, its shrunken walls and the adjoining dura showing a plastic exudate which indicated the extent of the inflammation. Since no clot could be turned out here; and since the infection which had caused the recent chills had apparently come from the upper jugular, further exploration seemed inadvisable, and accordingly the wound was packed and the dressing applied. There has been no return of the chills and no further evidences of either septicæmia or pyæmia, and the patient has progressed steadily towards recovery, the wound now being nearly healed.

DR. WILLY MEYER had had two cases of thrombosis of the internal jugular in which an operation had been previously done and the sinus exposed by an aural surgeon on account of conditions similar to the one reported by Dr. Dowd. In one case he had ligated the jugular vein just above the clavicle, and, in the other, the vein was so thoroughly thrombosed far down towards its entrance into the subclavian that he decided not to attempt to loosen it. In both cases the vein was not extirpated, but slit open in its entire length. In the first case irrigations could be made through the temporal bone and the fluid made to appear in the sinus; in the other case this could not be done. Both cases made good recoveries.

TUBERCULAR OSTEOMYELITIS OF THE TIBIA.

DR. CHARLES N. DOWD presented a child two years old who was in good health until the middle of April, when his mother noticed that he complained of tenderness over the middle of the left leg. At that time no swelling was apparent, and there was no history of injury. A slight swelling, however, soon appeared, and increased very slowly until his admission to St. Mary's Hospital, July 20. At that time it was about an inch and a half in diameter, was hard, and tender on pressure; it was on the anterior surface of the left tibia about its middle; the skin was freely movable over it, and there were no signs of acute inflammation. The bone, both above and below this point, seemed slightly thickened; his temperature was 100.5° F.; pulse, 120; respiration, 24. Operation was done July 24, and there was found to be an involucrum about the entire tibia, which at the point of great-

est swelling was one-half an inch thick, and over the rest of the bone was about one-eighth of an inch thick; this was removed over the entire anterior surface of the bone, which looked hard and almost normal; but on cutting through a spot which seemed a little softer than the rest, the entire bone cavity was found to show evidence of extensive rarefying osteitis; it was roughened; there were small sequestra, and the bone in many places was destroyed almost to the surface. All of the bone and involucrum between the two epiphyses was removed, excepting a small strip which was just sufficient to maintain the shape of the leg with the aid of splints and the fibula. The cavity was washed out with bichloride of mercury solution, 1 to 5000, and the periosteum and skin were sewed together with catgut, and a wet dressing applied.

The wound healed up promptly by primary union without incident. The accompanying photograph was taken fifteen days after the operation. The child has remained well ever since excepting for bronchitis, for which he is now being treated in the hospital. There is still very slight tenderness about the tibia.

The Pathological Report, which was made by Dr. Mathews, the hospital pathologist, was as follows:

Periosteum and medulla of tibial shaft.

Small masses of tissue.

1. Periosteum. The tissue shows production of periosteal bone and thickening of periosteum. It also shows discrete typical tuberculous lesions, *i.e.*, miliary tubercles with central necrosis and periphery of giant and epithelioid cells.

2. Medulla shows lesions of diffuse tubercle. No microscopic evidences of suppurative inflammation.

Culture smears on blood serum (Loeffler) remained sterile in thermostat.

Tubercular osteomyelitis of the large long bones is certainly among the rarer inflammations, the tubercular processes usually being confined to the epiphyses and to the tissues adjacent. It is mentioned by various authors, but is uncommon enough to warrant the presentation of this case to the Society. The entire history of the disease and the appearance at operation were those of subacute osteomyelitis, and the general disease of the medulla, the formation of sequestra and of involucrum, corresponded to that disease. The satisfactory healing by primary union is also



Tubercular osteomyelitis of tibia fifteen days after operation.

noteworthy in so extensive a bone lesion, and it emphasizes the desirability of attempting to gain such healing in the subacute cases. The strip of bone left was not strong enough to fasten nails to, according to Neuber's method, if one had been so disposed, and the spots of local inflammation which would have been thus closed would have been disadvantageous.

CHOLECYSTECTOMY.

DR. HOWARD LILIENTHAL presented a man, twenty-six years old, who had been admitted to the hospital March 14, 1903. He had had measles and rheumatism, but no typhoid fever. He had no jaundice. He had had hæmorrhoids for two years. During the past two years he had had several attacks of what apparently was biliary colic. He had never passed any stones, although stones had been looked for. The attack for which he came to the hospital had lasted seven days. He had cramps in the epigastrium. He had vomiting and, two days after, pain and chills. The next day his vomiting continued. For four days he was constipated. The pain was constant until two days before admission, when it began to diminish; it continued to be localized in the epigastrium. On admission, the patient had a temperature of 101° F. and no jaundice. The local and physical signs showed tenderness and rigidity in the right hypochondrium, the tenderness being one and a half inches above and to the right of the umbilicus. He was operated upon on the 17th of March. Three-inch rectus incision. The gall-bladder was removed after separating omental adhesions. It was about six inches in length, had thick walls, was full of pus, and contained eight stones. Ulcerations and gangrenous areas were present. The specimen was presented. The stones were fairly large. A few days afterwards he had hypostasis at bases of both lungs. He did not incise the common duct because there were no signs of general obstruction, and so he saw no reason for so doing. Chromic catgut was used to ligate the cystic duct. By April 8 the wound had healed nicely, and the patient had had no trouble since with his gall-bladder.

PYLOROPLASTY; GASTROJEJUNOSTOMY.

DR. JOHN ROGERS, JR., reported the case of a man, fifty-six years old, whom he had seen in December, 1902, with a dyspepsia

which had been of about twenty years' duration. Examination revealed a dilated stomach and palpation showed a possible tumor in the region of the pylorus. The patient had all the symptoms of a pyloric obstruction, and a tentative diagnosis of cancer was made, as the symptoms had become recently very much exaggerated. An incision was made in the right rectus muscle, and the findings were simply those of a thickened pylorus. The patient took ether very badly, and all attempt at pylorotomy was changed to hasty pyloroplasty. The pyloroplasty opening was large enough to admit of two fingers. The patient was all right until August last, when symptoms of obstruction again appeared. This showed the failure of the pyloroplasty operation, although the conditions for a success were good. On October 5 he did a gastrojejunostomy by a method which is used in many of the clinics abroad, but receives rare mention in this country. It consisted in a retrocolica posterior operation. The opening in the stomach was placed on the posterior surface near the greater curvature and in the jejunum within three inches of its origin. The jejunum was then sutured in the natural vertical position (which is its course in this part) to the posterior wall of the stomach. On October 15, ten days later, the patient returned to his shop. No disagreeable symptoms followed the procedure. This form of gastroenterostomy seemed to him to be a very useful method, and one that was not enough used in this country.

DR. ELLSWORTH ELIOT, JR., asked what was the condition of the stomach at the time of the second operation. He recalled a case in which all the symptoms of cancer of the pylorus were present. This patient was a woman aged forty years, and three years and a half ago, at the time of operation, he had found the pylorus to be the seat of a growth which was hard and nodular and had all the landmarks of cancer. As the general condition of the patient was such that no prolonged operation could be withstood, a posterior gastro-enterostomy with the Murphy button was done, and the abdominal wound closed. At the end of three or four months this patient had gained forty or fifty pounds in weight. She was then advised to submit to another operation for the removal of the tumor, and her consent was obtained. Upon opening the abdominal cavity no trace of the tumor could be found. The patient since then has continued to enjoy good health, without any symptoms of pyloric stenosis or evidences of any growth.

The Murphy button has never been passed, and the X-ray showed it still to be in the stomach. He had read of cases in which, at the original operation, the pylorus was resected for carcinoma, and in which a subsequent microscopical examination failed to detect the disease. The resemblance to carcinoma was in these cases believed to be due to a peculiar pyloric muscular contraction which resulted in a consistency which simulated the hard-like character of cancer. In the present instance, however, the growth noticed at the time of the original operation must have been the cicatrix of some prior extensive ulceration, and its disappearance must have been due to the removal of the irritation by the gastro-enterostomy.

DR. F. KAMMERER said that inflammatory tumors in the region of the pylorus simulating carcinoma were not so very rare. They frequently disappeared after gastro-enterostomy. In one of two such cases which he had observed a secondary laparotomy, some six or eight weeks after the operation of gastro-enterostomy undertaken with the idea of removal of the growth, showed that the tumor had entirely disappeared. The case had been demonstrated at one of the Society meetings several years ago, and he would not enter further upon its history.

DR. HOWARD LILIENTHAL said he had had three cases in which he had done the Finney operation, and he wished to speak in favor of it. The anastomosis will not contract. If the pyloroplasty opening remains at all patent, there was a strong probability that a coexisting Murphy button gastro-enterostomy would close. When Finney read his paper before the Society, he showed a stomach in which this had taken place. The Murphy button wound had closed, so that only a fine bristle could be passed.

DR. JOHN ROGERS, JR., said that the condition of the stomach in the first operation showed such a thickening of the pylorus that it simulated a cancer at that situation. Upon further examinations it was shown to be hard, but it did not cut like a cancer, and, therefore, he did not attempt to do more than a Heinecke-Mikulicz operation, making the incision through the under part of the pylorus and adjoining portions of the greater curvature of the stomach and first portion of the duodenum. It thus approached a Finney operation. At the second operation the thickening and hardness had disappeared from the pylorus. The finger was passed through the pylorus, and it was demonstrated that the

pyloroplasty had failed from cicatricial contraction. It had shrunk from a size admitting two fingers at the original operation in the previous December to a barely perceptible aperture.

CONTUSION OF ABDOMEN; RUPTURE OF THE SMALL INTESTINE; ENTERORRHAPHY.

DR. L. W. HOTCHKISS presented a man, twenty-one years of age, who was admitted to Roosevelt Hospital, September 2, 1903, with the history that while helping some other workmen to lift a heavy fire-shovel the patient received a powerful blow in the abdomen from the handle. He experienced immediately intense abdominal pain and began to vomit. He was brought to the hospital shortly afterwards by the ambulance. At the time of admission his condition was fairly good; there was very little or no shock; but he complained of great pain in the abdomen, and lay in bed with his limbs drawn up. There was well-marked rigidity, especially over the right side of the abdomen, and tenderness, with no evidence of any lesion of abdominal wall to account for it. His pulse was 80; respiration, 28, and entirely thoracic, and his temperature, 99.6° F. He was seen by Dr. Hotchkiss shortly after his injury, and, in view of the well-marked local rigidity, the great pain and vomiting, immediate operation seemed indicated in view of a possible intestinal rupture. The patient was prepared at once for operation and brought to the operating room a little less than an hour from the time of admission. Under gas and ether anæsthesia a laparotomy was performed, the incision separating the outer fibres of the right rectus muscle for about two inches above and below the level of the umbilicus. Gas, fluid, and some intestinal contents escaped on incising the peritoneum, and, after washing with saline solution, the coils of small intestines lying near incision on the right side of the abdominal cavity were examined. A rupture through all the coats of the jejunum was quickly found, isolated, and closed with fine silk sutures after Connell's method, the lower end of the tear being closed by a Lembert suture only, and the suture line fortified by one or two others. The tear involved nearly one-half of the circumference of the intestine, and extended from the mesenteric nearly to the free border in a direction at a right angle to the long axis of the gut. After thorough flushing of the peritoneal

cavity with warm saline solution, the abdominal wound was closed without drainage, and the patient returned to bed in very fair condition. The subsequent history of the case was uneventful. Vomiting occurred only once after the operation, and some slight colicky pains the first two days. There was some elevation of temperature, but no wound infection, and the healing was prompt and satisfactory. Rectal feeding was kept up for about ten days, and after this a gradual resumption of ordinary diet. The patient was discharged well on September 24.

The principal features of interest in the case are the character of the injury, the symptoms, rigidity, and continued vomiting, the early operation, and the efficiency of the Connell suture.

The case showed the value of sudden marked rigidity of the abdominal wall as an indication of rupture of the intestine. Although this is by no means pathognomonic, it is always suggestive in cases of this sort, and, taken in connection with the nature and situation of the injury, often justifies an exploratory incision.

HARELIP AND CLEFT PALATE.

DR. A. L. FISK read a paper with the above title.

DR. GEORGE WOOLSEY, in referring to the mortality from marasmus, said that the different results that were obtained in private and in hospital practice were very striking. He knew of one hospital surgeon who had given up operating for harelip in hospital practice on account of the bad results obtained. It must be remembered that the general condition of the harelip cases admitted to the hospital was bad.

Regarding the time for operation, he thought it was the wisest plan to wait until such a time when the tissues were strong enough to bear the sutures, so that they would not readily pull out. Again, he thought we should wait until the baby was old enough to stand the hæmorrhage. Very young babies do not stand bleeding well. He preferred to wait until after the second month.

With regard to cleft palate, it is certainly easier to wait until the child is four or five years old, when the mouth is larger. Especially since the appearance of Wolf's and Brophy's papers the tendency was to operate earlier. He had done Brophy's

operation in only one case, but he was not impressed with it. In this operation the patient must be very young, because then it was easier to bring the cleft together by twisting the wires.

DR. CHARLES N. DOWD said that there was one element in the method advocated by Brophy which he had considered with much interest, viz., the bringing down of mucous membrane from above the edge of the cleft, and hence avoiding the lateral cuts which are so often made. Brophy had specially devised periosteal elevators for this purpose, and used the method in children whose first teeth had appeared when the bones could not well be crushed together. The flap of periosteum and mucous membrane which was brought down was wider than that obtained when the edges of the cleft were denuded by cutting, but the tissue which was brought down from above the cleft was very thin in the two cases in whom he had tried the method. There was, however, a decided gain in the width of the flap.

DR. WILLY MEYER said that he did not advocate operating upon such cases before the end of the third month. He emphasized the importance of having the babies properly trained in using the feeding-bottles. The rubber nipples had to be so arranged that, when pressed by the lips, the milk would squirt out into the child's mouth.

Stated Meeting, November 11, 1903.

The Vice-President, HOWARD LILIENTHAL, M.D., in the Chair.

TENORRHAPHY.

DR. BERN B. GALLAUDET presented a man who was injured a year ago by an explosion of gas. Four of the extensor tendons of his left hand, including the extensor longus pollicis and brevis, were cut. Considerable retraction had occurred, and some difficulty was experienced in bringing together the ends of the divided tendons. The radial nerve had also been cut, and after uniting the tendons this was anchored into the fascia by means of a fine

catgut suture. The wound was closed and the hand put up in a position of hyperextension. Primary union occurred throughout, with the exception of a small area over the tendon of the extensor longus pollicis, where there was slight sloughing. The resulting sinus closed in about two months.

At the time of the accident there was marked numbness over the region of the radial nerve: this had practically disappeared.

CASE OF EXCISION OF KNEE FOR FLEXURE ANKYLOSIS.

DR. F. TILDEN BROWN presented C. K.; male; aged fifteen years; a native of the United States, who came under observation in June, 1902, with a right-angled flexure of the left knee. Despite the wearing of a high-heeled shoe, he walked in a crab-like fashion, the sound leg being kept voluntarily bent in order to help compensate for its flexed and ankylosed mate.

There was no family tuberculous taint, and the patient's history and present condition gave no evidence of any tuberculous foci, except in regard to this left knee.

When eighteen months old he fell out of an overturned baby carriage. Two months later there was a swelling of the left knee, which was opened in the popliteal region. Some two months later he was received at one of the hospitals in New York, and there treated for two years by an extension apparatus, and for an abscess in and about the knee. When the boy left the hospital, at the age of four and one-half years, his knee, although ankylosed, is said to have been but little bent, and he continued to wear a brace for three years; despite which flexure was gradually increasing. When examined, the boy was found fairly well nourished. The lower end of the sternum was somewhat prominent, as in pigeon breast. Heart, lungs, liver, and spleen gave the physical signs of normal organs. The left knee presented an ankylosed flexure of eighty-five degrees. Numerous transverse and vertical scars were about the joint, and the length of the knee showed striking evidence of the abnormal epiphyseal growth. As the boy and his mother desired a surgical correction, a cuneiform excision of the knee was made on August 26, 1902, at the Presbyterian Hospital, under gas and ether anæsthesia.

A transverse incision was made from the outer to the inner condyle; tissues and periosteum reflected; wedge-shaped piece

of the femur and tibia, three and one-fourth inches wide at its base, was removed by saw. On straightening the leg it was found necessary to remove small similar sections, with a total additional base of one and five-eighths inches, to obviate bony interference with full extension. And now, although the bony hiatus was large enough not to prevent full extension, nevertheless the hamstring tendons and bound-down popliteal vessels were the cause of limitation, permitting only of about 170 degrees of extension. Bony, periosteal, and cutaneous tissues were separately sutured. During this procedure, as well as the application of plaster-of-Paris splint, forcible extension was exerted. On reaching his bed the boy was put in a Volkman sliding extension splint with weights, and so retained for a month. Primary union, and convalescence was uneventful. He was discharged seven weeks from the time of operation, still wearing a well-fitting plaster-of-Paris splint. For a week before discharge he had been permitted to use the leg a little in walking, braced, of course, by the splint; despite the precautions, there seemed to be a slight evidence of a recurring flexure. At this juncture he was fortunately able to elicit Dr. W. R. Townsend's interest in the case, and by his personal oversight in the matter of various braces, which have been worn now for over a year, the leg is even straighter to-night than when he left the hospital.

In view of the great difficulty met at the time of operation to extend the leg more than to 170 degrees even after the removal of a bony triangle, the anterior face of which was more than five inches,—and this limitation being recognized as due to tension of the flexor tendons and popliteal vessels,—it is not easy to understand how works on orthopædic surgery advocate the correction of such ankylosed deformities by forcible flexion and extension without any cutting other than a previous tenotomy. It seems certain that the popliteal artery could not have escaped rupture in this particular case had such a practice been here attempted, for the old popliteal cicatrices had bound the artery so firmly to the adjacent tissues as to give it a dangerous tension on closing the hinge after the general generous excision here done.

DR. W. R. TOWNSEND has kindly contributed the accompanying notes to Dr. Brown's case:

C. K. came to the Out-Patient Department of the Hospital for Ruptured and Crippled, October 15, 1902, with a flexion



Ankylosis of the knee in flexion; corrected by excision.

deformity of nearly twenty degrees following an excision of the knee. As this patient had suffered the removal of so much bone at the time of operation, it was not deemed advisable to do another excision or osteotomy, but to treat him by means of a Thomas knee-brace, with extension straps, applied to go inside of the leg-bars and fasten to the footpiece. Direct traction was thus made on the tibia and fibula and counter-traction made by the ring passing around the upper end of the thigh. The limb was thus gradually pulled down and, as the boy grew, straightened. This method is particularly applicable to cases where, after excision, there is a little deformity remaining, and the bony union between the excised fragments is not perfect.

The necessity for after-care in these cases is very great, and the number of patients who apply at the Hospital for Ruptured and Crippled suffering from relapses after excisions is quite large, the most common deformity being the flexion. In this instance the flexion was not a relapse, because the limb had to be placed in flexion, and to have removed any more bone would not have been proper, and would have sacrificed very materially the growth of the leg, and to forcibly straighten it might have caused serious damage by rupture of the popliteal vessels.

DR. ROYAL WHITMAN said that in childhood a stiff knee would almost invariably become flexed unless it was protected. He thought in such cases, in the younger class, it would be unfortunate if one were obliged to resort to a cuneiform excision which would remove the epiphyseal cartilages in whole or part. Except in extreme case, if the deformity could not be overcome by correction within the joint, he would favor simple osteotomy of the femur just above it. In many instances preliminary division of the hamstrings might be required, and it was often advisable to straighten the limb at several sittings, allowing intervals for the adjustment of its circulation to the new conditions.

CASE OF TRAUMATIC HERNIA; PRIMARY STRANGULATED INGUINAL HERNIA SYNCHRONOUS WITH EXTERNAL VIOLENCE.

DR. F. TILDEN BROWN presented J. B.; male; eighteen years; groom. On the morning of April 9, 1902, being called to an accident case at the Riding Club, I found the patient lying

on his side, his legs drawn up and his hands pressed over the lower left part of his belly. Attitude and facies were both corroborative of the pain of which he complained, most in the left inguinal but to some extent in the umbilical region. Pallor of face and perspiring forehead accompanied nausea, but he had not vomited for nearly half an hour before. While riding, the horse reared and fell backward upon him. He immediately felt a pain in the left groin and could not stand upright. On handling himself, he discovered at the place of greatest pain a small lump on the left side of his scrotum, which had never been there before.

Examination confirmed this observation, and showed a very tense and quite tender tumor of hickory-nut size just below the left external ring. Both testes were of normal size and at the lower part of the scrotum.

Placing the patient in a moderate inverted posture on cushions, with flexed thighs, after two or three minutes of forceful and even taxis, somewhat sudden reduction of the tumor was effected, attended with an immediate relief of the severe pain. Compression bandage was applied, and the patient removed to his home. He remained in bed eight or nine days, having some tenderness in the left inguinal region and a moderate ecchymosis of the left side of scrotum. The external ring and canal were not larger than normal, and in fact not seemingly as large as they were on the right side. The patient had never had any previous symptoms suggestive of an incipient rupture. He had been a jockey and riding groom since he was a small boy, and wishing to be in the best state to continue this avocation, he asked for a radical operation, for which he entered the Presbyterian Hospital thirteen days after the accident. Examination at this time failed to discover any evidence of a hernia, straining and coughing could effect no protrusion even into the canal. His abdominal walls were firm, and the sensation imparted over each internal ring to the examining finger was the same. Operation on April 22. Gas and ether anæsthesia. At the uppermost part of the opened inguinal canal a small pouch was found and opened. Adherent to its inner surface was a quill-size extension of omentum which was easily freed. A purse-string catgut suture was carried through the base of the pouch. The wound and

cord were treated after Bassini's method, with chromicized catgut. Bowels moved the third day. Uneventful convalescence. Primary union, and discharged on May 15.

Finding this very short sac with adherent omentum was proof enough that rupture existed, and while the exact date of its inception must remain undetermined, there is no question but that the direct exciting cause of its first appearance and sudden strangulated protrusion were violent compression of the parietes. It seems strange that such a combination of circumstances, causative of rupture, should be so rare. In Coley's report of a thousand operative cases, none presented a similar history of onset. In Bull and Coley's article in Dennis's "System of Surgery," in allusion to causation of hernia, it is stated that "in a few well-authenticated cases a pronounced hernia has immediately followed a sudden strain when absolutely no sign of a hernia had existed previously. In a few of these cases strangulation has occurred synchronously with the first appearance. Such cases are very rare, but should be borne in mind." The authors cite two cases seen at the New York Hospital during seven years, where the occurrence of a strangulated inguinal hernia had been sudden and without premonitory symptoms, unless the existence in one case of an undescended testis might be classed as such. In neither case was there any abdominal compression, nor could any unusual muscular exertion be cited as an etiological factor. The same article mentions that one somewhat similar case involving the femoral region had been observed at the Hospital for Ruptured and Crippled. The mechanism of the hernia in the case shown would seem to be adequately explained by the elastic compression theory, where, if any had previously existed, it was but a shallow sac that had never before reached nearly to the external ring. A sudden and unusual intra-abdominal pressure exerted by an outside force expressed a loop or lateral wall of bowel with force enough to protrude it through and beyond the external ring, where it was held by the constricting arch of the dense elastic fibres of the aponeurosis of the external oblique until overcome by taxis.

DR. WILLIAM B. COLEY regarded Dr. Brown's case as one of the most remarkable cases of hernia that had ever been presented to the Society. The speaker said he had recently had occasion to look up the subject of traumatic hernia, and in reviewing

the history of over 50,000 cases observed at the Hospital for Ruptured and Crippled he had found not more than four in which there was a probability that direct traumatism was the cause of the rupture, and even in these four the proof was not absolute. One of the cases was that of a man who had been operated on by Dr. Coley for an inguinal hernia. The operation had been done two or three years ago, and a recent examination had shown no signs of a recurrence. A few days later the man was kicked directly over the scar, and immediately afterwards the hernia reappeared. In two of the other cases the hernia apparently developed after a kick, and in the fourth it appeared after the patient was thrown against a hard object. In the two cases in which the hernia followed a kick, there was no history of a previous examination, and the hernia might have existed prior to the accident. That possibility should always be borne in mind. It is not uncommon that a patient who comes for treatment of a hernia on one side is found to have one on the other side which he had never discovered, and in such a case, given an accident, its presence might easily be attributed to a traumatism. Dr. Brown's case seemed to fulfil the requirements of a hernia due to direct violence better than any he had ever seen or heard of. Two authentic cases had been reported in Germany, one by Belfinger and the other from Von Hacker's clinic.

STRANGULATED INGUINAL AND PROPERITONEAL HERNIA.

DR. GEORGE E. BREWER presented a negro, aged thirty-eight years, who was admitted to the Roosevelt Hospital in August, 1903. He had suffered from a left oblique inguinal hernia for a number of years, which was usually well retained by a suitable truss. On several occasions during the last four years, in the absence of his truss, a protrusion of the hernia had occurred, which had become temporarily incarcerated, giving rise to pain, vomiting, and moderate prostration. These attacks, however, had generally been relieved by rest and taxis.

When admitted to the hospital there was an oblong tumor, about the size of a closed fist, occupying the inguinal region and upper part of the scrotum. This was markedly tender to pressure.

The patient had been vomiting for about twenty hours, and complained of severe pain in the lower abdomen. He was immediately prepared for operation, and under ether anæsthesia taxis was attempted for a few minutes, but without success. An incision was made over the tumor and the various layers of tissue divided until the sac was reached and opened. Within the sac, which was apparently divided into two compartments by constricting bands, there was found about four inches of dark-colored intestine and a small amount of bloody serum. When the constriction was relieved, the intestine slowly regained its normal color and was easily reduced. When about to close and remove the sac, preparatory to performing the Bassini operation for the radical cure, the finger was introduced, presumably into the peritoneal cavity, and though the intestines were distinctly felt, and the walls were apparently lined with smooth peritoneum, the cavity appeared decidedly restricted.

A wide incision was then made through the internal oblique and transversalis muscles, and a large coil of small intestine found in a third upper compartment of the hernial sac, which occupied a position between the parietal peritoneum and the muscular wall. The properitoneal sac communicated with the general peritoneal cavity by a constricted orifice, not narrow enough to cause strangulation, but which might easily interfere with the patency of the gut if it became distended. The peritoneal ring was freely divided and the intestines returned to the peritoneal cavity. The peritoneum was united and the wound closed above, layer by layer, and by the Bassini method below.

As there had been extensive transverse division of the muscles, the patient remained in bed six weeks. The healing was without infection, the stitches being removed on the tenth day. He had since been well.

EPIPHYSEAL SEPARATION AT THE UPPER EXTREMITY OF THE HUMERUS, WITH GREAT DEFORMITY.

DR. GEORGE E. BREWER presented a girl, aged thirteen years, who was admitted to the Surgical Division of the Roosevelt Hospital in August, 1903. One hour before admission she had fallen down an air-shaft, a distance of five stories. When brought to the hospital she was in a condition of profound shock and semi-

conscious. The surface of the body was cold, the temperature subnormal, and the pulse almost imperceptible. There were numerous bruises over the body, especially over the right side of the abdomen and thorax, and in the region of the right shoulder. In the latter situation there was also considerable swelling, marked ecchymosis, and tenderness to the touch. As her general condition was grave, no attempt was made to examine the shoulder more carefully at the time. She was given an intravenous saline solution, and otherwise treated for the condition of shock.

Two or three days later she was more carefully examined, when it was found that there was abnormal mobility and deformity at the shoulder-joint, but without marked crepitus.

When her general condition had sufficiently improved to warrant her being moved, an X-ray picture was taken, which revealed an epiphyseal separation at the upper extremity of the humerus, the epiphysis apparently lying in the joint cavity, the upper extremity of the shaft being pushed outward and upward, and lying beneath the skin to the outer side and posterior to the acromion. Under ether anæsthesia an attempt was made at reduction by manipulation. Strong downward traction was made upon the arm, and when the shortening was overcome the elbow was carried vertically upward, as suggested by the late Professor E. M. Moore. These manoeuvres resulted in a complete disappearance of the deformity; the arm was secured to the chest by a plaster Velpeau dressing. A subsequent X-ray picture showed the fragments in their normal position.

ACUTE INFECTIOUS ARTHRITIS OF THE HIP-JOINT TREATED BY INCISION.

DR. ROYAL WHITMAN presented a girl, ten years of age, who was brought to the hospital in July, 1903, with the history that she had been very ill for two months. The child was suffering great pain; she was much emaciated and unable to stand. There was a large abscess over the outer aspect of the left thigh and the corresponding hip-joint was apparently diseased. After emptying the abscess the joint was opened and the head of the bone turned out of its socket. The cartilage was destroyed in places and the neck of the bone eroded. The acetabulum was partly filled with granulation tissue; this was removed. The abscess



FIG. 1.—Incarcerated inguinal hernia, anterior view.

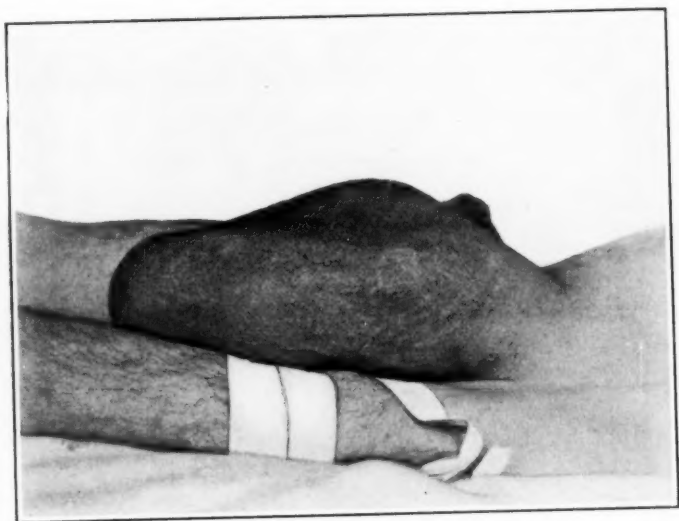


FIG. 2.—Incarcerated inguinal hernia, lateral view.

on the thigh did not communicate with the hip-joint. The head of the bone was then replaced, the wounds closed, and a plaster spica was applied. She now walks with but a slight limp. There is no displacement at the hip, no shortening of the limb, and the movements are but slightly restricted. There is no sign of disease. It is probable that the function of the joint will be eventually normal.

LARGE INCARCERATED HERNIA.

DR. CHARLES H. PECK presented a man, thirty-seven years old, who was admitted to the French Hospital in October, 1903, with the history of having had a left inguinal hernia for fourteen years. He wore a truss for a time, but during the past few years the hernia had been about the size of his fist and irreducible, and he had left off the truss. On the night previous to his admission, while working, the hernia suddenly increased enormously in size, reaching almost to his knees, and was tense, tender, and painful. (Figs. 1 and 2.) It was operated upon without delay, eighteen hours after the sudden enlargement; on opening the sac, the neck of which was constricted at both external and internal rings, a large amount of fluid escaped; the remaining contents of the sac consisted of the entire cæcum with the vermiform appendix, ileo-cæcal junction, and the commencement of the ascending colon, together with coils of small intestine. The wall of the cæcum was thickened, and it was much dilated with an old constriction just above the ileocæcal junction; the appendix had no mesentery, but lay beneath a layer of peritoneum along the posterior aspect of the ileum. The coils of small intestine had descended behind the cæcum, evidently having caused the sudden enlargement. There was no strangulation. After relieving the constriction and placing the patient in the Trendelenburg position, the intestine was returned to the abdominal cavity. After reduction of the cæcum, a fold of peritoneum attaching the commencement of the ascending colon to the posterior abdominal wall just within the neck of the sac could be seen and felt; it was apparently the lower end of the ascending mesocolon, attached well to the left of the median line. The deep epigastric artery was felt to the inner side of the neck of the sac, proving the hernia to be of the oblique variety. The wound was closed by the Bassini method

with chromic catgut, the result being quite satisfactory in spite of the enormous stretching of the tissues. A cigarette drain was placed at the lower angle in the great cavity in the scrotum. The wound healed by primary union without incident.

Dr. Peck stated that the man also had a reducible right-sided omental hernia, which he intended to operate on shortly. The case was interesting on account of the huge size of the hernia, its unusual contents, and the satisfactory result of the operation. He thought it rather unusual to find the cæcum and appendix in a left inguinal hernia.

(The right hernia has since been operated on by the Bassini method, a piece of omentum eleven inches long by three and one-half inches wide being excised.)

DR. GEORGE WOOLSEY said that while the case of incarcerated hernia presented by Dr. Peck was remarkable as to size, the character of the contents of the hernial sac was not very unusual, quite a number of such cases being on record. The size of the hernia reminded Dr. Woolsey of a case which he operated on two or three years ago, and in that instance the sac contained a large amount of fluid and a considerable portion of the large intestine, including the sigmoid and descending colon. The cause of the large amount of fluid showed itself later in the presence of a new growth involving the intestine and omentum.

SPLINT FOR FRACTURE OF JAW.

DR. CHARLES H. PECK presented a young man who was admitted to the French Hospital on October 6 with a fracture of the inferior maxilla through the lower part of the ramus. In spite of the application of the ordinary dressings, there was persistent posterior displacement. In order to overcome this difficulty, the House Surgeon, Dr. Clinton B. Knapp, suggested the use of a splint which he had devised to overcome a similar difficulty in a previous case. It consisted of a strip of tin five inches wide in front tapering to three inches posteriorly, the anterior end bent upward to form a projecting shelf, and the strip fitted to the head, to which it was fastened by a circular plaster-of-Paris bandage. Its anterior curved end projected from the forehead, strips of adhesive plaster passing from the shelf downward and backward beneath the jaw, exerting traction upward and for-

ward, which entirely overcame the posterior displacement. Posteriorly the centre of the tin splint was cut away to avoid pressure on the occipital protuberance.

DR. GALLAUDET said that very recently he saw a case of fracture of the inferior maxilla which demonstrated the futility of the ordinary four-tail bandage. In order to keep the fragments in apposition, he applied a narrow iron brace extending from the upper spine to the occiput, and thence over and beyond the forehead. This was kept in position by means of a plaster-of-Paris bandage, and by its aid a bandage was applied which prevented displacement of the fragments.

DR. LILIETHAL thought it advisable that in the treatment of a fracture of the lower jaw the surgeon should always associate with himself a dentist, and that in addition to the external apparatus an interdental splint should be applied to hold the teeth in proper occlusion; otherwise even slight irregularities of occlusion might give rise to a great deal of trouble. The interdental splints were made of metal, extremely thin, so that the patient hardly knew he had anything in his mouth.

DR. PECK, in closing, said that in a previous case treated at the French Hospital the interdental splint had been tried and had proved a total failure. The displacement could not be corrected by any of the ordinary splints. In cases where the fracture passed between the teeth, the interdental splint might prove serviceable.

GASTROSTOMY FOR ŒSOPHAGEAL STRICTURE.

DR. F. W. MURRAY presented a man, fifty-six years old, who came under observation in May, 1903, with the history that up to eight months previous to that time he had enjoyed excellent health. He then first experienced some difficulty in swallowing, and in two months he was unable to swallow any solid food. The dysphagia gradually became more pronounced until he could no longer swallow milk. He became greatly emaciated, losing about fifty pounds in weight.

Upon admission to the hospital, an Œsophageal bougie was introduced, which revealed a stricture thirteen inches from the teeth line. It was very firm and gristly to the touch, and would not permit the passage of any instrument into the stomach. Even a small shot attached to a string failed to pass the constriction.

A gastrostomy was accordingly done, and since that time, a period of about six months, the patient has been feeding himself through the gastrostomy wound. Since the operation the man's weight has increased from 144 to 190 pounds. The patient had suffered considerably from hoarseness, and a laryngoscopic examination showed a general congestion of the larynx and partial paralysis of the left vocal cord, probably from pressure.

Dr. Murray said he was inclined to regard the stricture of malignant origin, although the improvement in the man's condition since the operation rather militated against that diagnosis. There was no history of syphilis nor ulceration of the œsophagus.

DR. ALEXANDER B. JOHNSON said that the cause of the œsophageal obstruction in Dr. Murray's case was possibly an aneurism, although its location would hardly correspond with that of an aneurism of the arch of the aorta. The partial paralysis of the left vocal cord rather favored that diagnosis.

DR. ELLSWORTH ELIOT, JR., recalled the case of a man of sixty years who developed an impassable stricture of the œsophagus, accompanied by a loss of flesh which was fully as great as in the case reported by Dr. Murray. A gastrostomy was done, which was followed by marked improvement. The man lived for ten or eleven years after the operation, and during that time he received all his nourishment through the gastrostomy wound. Those who had charge of the case were inclined to regard the stricture of specific origin.

Another case recalled by Dr. Eliot was that of a man of fifty-two years with an impermeable stricture of the œsophagus of doubtful origin. After gastrostomy he gained about forty pounds in weight and was able to return to his work. He died suddenly six months after the operation, and the autopsy revealed the fact that a malignant growth of the œsophagus had perforated through the pericardium.

The speaker said that, as a rule, the improvement following operation in these cases did not last long, but occasional exceptions had been recorded, especially with the scirrhus type of cancer, which was not unknown in the œsophagus.

He desired to inquire whether the patient had ever been infected with syphilis, and whether he had been subjected to mixed treatment.

DR. F. KAMMERER recalled one case of stricture at the lower end of the œsophagus, with marked impairment of the general health, where gastrostomy was followed by material improvement, and the patient lived for over two years after the operation. During this period he was fed entirely through the gastric fistula. The original diagnosis of malignant disease in that case was verified at autopsy. The patient had suffered from repeated hæmorrhages after operation, although bougies were never passed.

Dr. Kammerer said he was inclined to believe that the case shown by Dr. Murray was one of malignant disease of the œsophagus, situated somewhat below the level of the bifurcation of the trachea.

DR. MURRAY, in closing, said that an X-ray picture in his case had failed to show any shadow. This would militate against the diagnosis of aneurism, as would also the fact that the stricture was completely impassable. The speaker said he agreed with Dr. Kammerer that the case was one of cancer, probably of the scirrhus type. He thought it was located below the bifurcation of the trachea.

PARTIAL ENTEROCELE.

DR. LUCIUS W. HOTCHKISS read a paper with the above title, for which see page 258.

DR. COLEY said he had had but a single experience with a partial enterocele. The case was one upon which he operated about three years ago for a strangulated hernia of fifteen hours' standing. The patient's temperature was 101° F.; he was vomiting, and complained of considerable pain. An immediate operation revealed a properitoneal hernia with a tight constriction involving about two-thirds the lumen of a knuckle of small intestine. The constriction was reduced without resection, and the patient made an uninterrupted recovery.

DR. CHARLES N. DOWD referred to a case of partial enterocele in a child which was interesting from a diagnostic stand-point. When the patient was brought to the hospital he had fæcal vomiting, and was in a depressed condition. The history given was, that a hernia had existed, but it had apparently been reduced, and no traces of it could be found, even with one finger introduced into the rectum and the fingers of the other hand pressed

over the inguinal region. On account of the faecal vomiting, an incision was made over the inguinal canal, and a partial enterocele was found. The constricted section of gut was not large enough to be felt through the pubic fat. The patient recovered without incident.

DR. JOHN B. WALKER reported two cases of partial enterocele which had come under his observation. One was in a woman of fifty years with a hernia that had been strangulated for forty-eight hours. An operation was followed by recovery. The other case was that of a man of sixty years with a strangulated femoral hernia that had apparently been reduced. The symptoms of strangulation, however, did not abate, and after seventy-two hours a resection was done. The case resulted fatally. The speaker said his experience did not lead him to favor resection in the treatment of these cases.

DR. PECK reported the case of a woman of sixty years who gave no history of hernia, but who had suffered from intestinal obstruction for two days. Upon placing her on the table preparatory to operating, a protrusion could be felt over the right femoral ring. A herniotomy revealed a constriction of the intestine which included fully three-fourths of the lumen of the gut. The constriction was relieved, and, as the gut was in fairly good condition, it was returned to the intestinal cavity. The patient, who was in profound collapse at the time of the operation, failed to rally, and died in forty-eight hours.

DR. LILIENTHAL mentioned a case of partial enterocele without gangrene, which he operated on and which made a perfect recovery. In cases where gangrene of the gut has occurred, the speaker emphasized the importance of extending the resection well beyond the actual limits of the diseased area on account of the well-recognized fact that the tissues of the adjacent gut are liable to have become devitalized. In cases where an intestine of doubtful integrity had been put back, it was his practice to pass a long rubber ligature through neighboring healthy mesentery, the ends being left within reach, and by means of which the implicated gut could be readily withdrawn if the necessity arose.

ABERRANT ADRENAL GROWTHS.

DR. F. TILDEN BROWN showed a unique specimen of this kind which he had removed last September from the right side of a male Cuban, forty-six years of age, whom he had arranged to show this evening, and would have done so but for an attack of pneumonia developing a few days ago. It was an enormous tumor, lobulated like a foetal kidney, and composed entirely of adrenal tissue, no vestige of renal glomeruli being thus far found.¹ The structure of the growth is of great interest in connection with the fact that two years ago, when Dr. Brown first saw the patient, there existed anuria on this right side, as was proven by two ureter catheterization tests at about a three weeks' interval. On the second occasion the ureter catheter was retained for nearly three hours, and the patient, at times in the vertical position, walking about. At this time the kidney was not appreciably enlarged. It was not palpable, but the examination elicited a trifling tenderness. An X-ray plate was negative, and tubercle bacilli were not found in the sediment of the voluntarily voided urine. No diagnosis was reached. And as the patient had during his summer visit North improved in health and gained in weight, as well as noted a nearly complete cessation of hæmaturia, he was advised to return to Cuba and report his condition from time to time. Such messages were always to the effect that blood was no longer seen in the urine, or but a faint shred of it at long intervals. No allusion was made to a tumor development in the side. For this reason the appearance he presented when appearing again this past summer was at once a surprise and a revelation. Neither vest nor upper part of the trousers could be brought together by their buttons. This in conjunction with the past history afforded a ready diagnosis of renal growth. The first suspicion of any ailment had been noted by this patient three years before, when one night he saw blood in his urine and had a pain in the right side. Such attacks of hæmaturia with or without pain had recurred at almost regular monthly intervals on five occasions, with an average duration of thirty hours. Then for some three months the appearance of blood in the urine was of irregular,

¹ One section shows the remnants of two uriniferous tubules.

shorter duration, but more frequent occurrence, until at the end of about ten months from the first onset it had practically ceased altogether. Dr. Brown said he expected to give a complete history of the case at some future time in conjunction with a review of these interesting but not at all uncommon renal neoplasms. In regard to the case just reported, the speaker said the facts noted afforded some reasons for the query as to the possibility of a kidney being so entirely made up of adrenal gland tissue, even at a time when it was not appreciably enlarged, as to be practically functionless as an excretory organ.

He would now only like to take advantage of the opportunity to briefly show several kidneys in which more or less of each gland had been supplanted by aberrant adrenal growth. One of these, a large, solid organ, had been removed by Dr. McCosh a few days ago from a man of sixty-five years, who had had his first symptoms, consisting of hæmaturia, some ten years before. In this case, also, there had been cessation of this symptom for a long time. Another similar specimen, but not so large, was the result of a successful left nephrectomy in a male adult by Dr. W. N. Swift, of New Bedford. In this case a recent note from the operator reports that the patient died two years afterwards from metastasis. The fourth specimen, and one showing a small lemon-sized growth in the upper pole of a left kidney, was removed at autopsy from a woman dying of iliac thrombosis following hysterectomy. Here there had been no renal symptoms whatsoever.

DR. LILIENTHAL said he had seen three cases of aberrant adrenal tumors. In two of these the growths were very large. The first case was in a man who died from a prompt recurrence. The second case was in a woman who was operated on a year ago. Very recently she developed a tumor in the frontal region which had every appearance of an aneurism. Upon exposing it, he found that it apparently communicated with the brain or possibly with the diploë. The speaker said it was well known that these adrenal growths were apt to recur in the liver or bones. While the frontal tumor in this case had all the signs of an eroding aneurism, it might be a very vascular growth secondary to the adrenal tumor which was removed a year ago. The first and most important symptom in all these cases, Dr. Lilienthal said, was renal hæmaturia.



Adrenal tumor.

DR. ELIOT, who had seen Dr. Brown's patient prior to operation, said the man was very cachectic, and had this immense tumor over the region of the right kidney. The growth was partially cystic, which was due to obstruction by portions of the tumor of several of the calices of the organ.

DR. A. J. McCOSH said that in his case hæmaturia appeared seven years prior to operation; it had been intermittent in character, but it had been more or less constant during the four years prior to removal of the kidney.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, May 11, 1903.

The President, RICHARD H. HARTE, M.D., in the Chair.

GASTRIC AND DUODENAL SURGERY.

DR. WILLIAM J. MAYO, of Rochester, Minnesota, read a paper entitled "A Review of 303 Operations upon the Stomach and First Portion of the Duodenum," for which see ANNALS OF SURGERY, July, 1903, page 30.

PROFESSOR VON MIKULICZ, of Breslau, said that the question discussed by Dr. Mayo as to which is the best operation for establishing a new communication between stomach and small intestine is of the greatest importance, but he did not consider this question to have been finally decided. There is no doubt but that operation is the best one which most completely restores the physiological relations. From this stand-point the operation of pyloroplasty stands at the head. Next in importance is the operation of gastroduodenostomy. If one of these two operations for technical reasons should not be feasible, one then has to consider the operation of posterior gastrojejunostomy according to Von Hacker, which, if correctly performed, yields excellent results. Least to be recommended is the operation of anterior gastroenterostomy. He would no longer perform this latter operation in benign affections of the stomach, on account of the most recent experiences which have shown that a peptic ulcer of the jejunum occurs after such operations with relative frequency. He considered this operation permissible only in gastric carcinoma in which the normal acidity of the gastric juice is absent.

As to Finney's operation, he considered it a very practical technical modification of pyloroplasty, but in the main one accom-

plishes precisely the same with the original operation of pyloroplasty, providing this operation is only properly executed. As to the Murphy button, in benign affections of the stomach, he did not employ it. In operations for gastric carcinoma, however, he employed it very frequently, as also in gastro-enterostomy and in resection. In the latter operation he considered the Murphy button indispensable, whether he operated according to the first or second method of Billroth. The technique is simpler, quicker, and much safer. When it is possible, he employed the first method of Billroth, which is the joining of the stump of the stomach with the duodenum, because this method again restores completely the physiological relations. Only in cases where this method cannot be performed, on account of either shortness or immobility on the part of the duodenum, did he employ the second method of Billroth, namely, the joining of the stump of the stomach with the jejunum. Regarding the relation between the number of benign and malignant diseases of the stomach, it had impressed him that in America the former, especially gastric ulcer, was the more numerous class, while carcinoma of the stomach occurred relatively less frequently. In Germany this proportion is reversed; at least he as a surgeon saw four times as many gastric carcinomata as gastric ulcers with their complications. Perhaps the frequency of gastric ulcer in America may be associated with what in our estimation is the not very natural nourishment which the American ingests, namely, ice-cold drinks and highly seasoned foods.

As far as the indications for operative procedure in gastric ulcer are concerned, it must not be forgotten that in this disease medical treatment is able to contribute much benefit. Furthermore, the surgical experience in this direction is still far too meagre to enable one to positively contend that in the operative procedure there is an infallible remedy for gastric ulcer itself. The whole question is by no means as yet decided, and therefore German surgeons are very reserved in considering the indications that are present in simple gastric ulcer.

Other cases, of course, are to be considered according to the complications which offer clear indications for operation, as, for instance, stenosis of the pylorus and hour-glass stomach.

In acute hæmorrhage they refrain, as a rule, from looking for the bleeding ulcer, as this is generally a too difficult and

unsafe a procedure. They do, however, perform gastro-enterostomy and at the same time a jejunostomy, as by means of the latter the patient may be exclusively nourished for weeks, and only in this manner the functional activity of the stomach is eliminated. As far as the localization of gastric carcinoma is concerned, his experiences did not coincide entirely with those of Mayo. If the results of post-mortem examinations are compiled, it will be found that certainly in the majority of cases the pylorus is included in the carcinomatous process. If, however, the results of the operations are considered, that is in the earlier stages of carcinoma, it will be found that the lesser curvature is most frequently affected by the carcinoma, which then attacks the pylorus secondarily. According to his experience, carcinoma of the stomach is situated in about 40 per cent. of cases primarily in the lesser curvature, and only in 20 per cent. of cases primarily in the pylorus. As far as the technique of the radical operation for gastric carcinoma is concerned, he referred to his numerous publications on this subject. For the last eight years, as a matter of principle, he had not only extirpated all the lymphatic glands at the greater curvature, but also the whole omentum with the lymphatic glands and lymph channels as far as the cardia. The technique is accurately published in the text-book of practical surgery by Von Bergmann, Von Bruns, and Von Mikulicz. The permanent results following resection of gastric carcinoma are in the main quite encouraging. His statistics show that 16 per cent. of those operated upon remain free from recurrences for over three years. But also in those cases which are not radically cured, resection of the stomach yields more than gastro-enterostomy. Some of the cases do not have any local recurrence, but after a longer period has elapsed metastases develop, living from one and one-half to two and one-half years without gastric disturbances. He therefore preferred resection of the stomach to gastro-enterostomy, even if there are no positive prospects present for a radical cure of the carcinoma.

MR. B. G. A. MOYNIHAN, Leeds, England, said that he thought the operation of pyloroplasty might be practically discarded. He had only done the operation three times. In the first the patient made a good recovery, and was one of the most satisfactory stomach patients that he had ever operated upon. Of the remaining two cases, one was partially improved; in the

other a gastro-enterostomy was performed four or five months after the original operation. He felt very decided that the operation of pyloroplasty was by no means so satisfactory in any single particular as the operation of gastro-enterostomy. For simple diseases of the stomach he had operated up to the time of his leaving England upon about seventy-five cases with only one death.

He had used the Murphy button, but in the last sixty-five operations that he had done he had not used it. The button had, however, been a very important step in perfecting his operation of gastro-enterostomy. It had taught him to remove the mucous membrane, which is so necessary in order to secure perfect anastomosis with an opening patent from the first.

Dr. Mayo had laid down the laws for the treatment of malignant disease of the stomach on almost the same lines as he had emphasized some two years ago in a paper read before the Clinical Society of London. The extension of malignant disease occurs principally through the lymphatic system. He described three areas,—one along the greater curvature, one along the lesser curvature, and one at the fundus, an area which he had described as an "isolated area." In the beginning he removed the whole of the lesser curvature, and the whole of the greater curvature up to the level of the hilum of the spleen. This leaves the "isolated area" of the stomach, and the only disadvantage that it has is that the pathology is not perfect, because the lymphatics of this area are in association with the lymphatics of the lower end of the œsophagus. In reference to the question of duodenal ulcer, as the cases had come to him, he thought it is very seldom primary. He did not remember ever seeing duodenal ulcer without a gastric ulcer. It is known that gastric ulcer is frequently associated at some period with hyperchlorhydria. There result first the gastric ulcer, and then a peptic ulcer in the first portion of the duodenal wall. He had seen cases similar to those which Dr. Mayo had described in which there was gastric ulcer, and a gastro-enterostomy was done, and peptic ulcer was formed in the outside loop of the jejunum. Gastric ulcer is frequently multiple. In a very considerable number of cases, roughly speaking, gastric ulcer is not a solitary condition; there are more ulcers than one in the majority of cases. Therefore excision of gastric ulcer is very rarely necessary. He

had excised the ulcer for hæmorrhage in one case only, and that case died. This was the only case which he had lost. In the other cases he had performed the operation of gastro-enterostomy without bothering much about the ulcers.

DR. ALBERT VANDERVEER, of Albany, said that although in past years he had felt that ulcers of the stomach could be largely benefited and brought to recovery by a medical line of treatment, and he had presented a number of cases in an article on the subject some years since, yet he realized the very impressive lesson brought out by Dr. Mayo in his large number of cases, the great majority being chronic ulcers, which gave a very positive evidence of the tendency of the cicatricial areas to later present malignant degeneration. He endorsed all that Mayo had said upon this subject, and could not agree with some of our writers at the present day that ulcer of the stomach is not a surgical lesion.

In regard to the surgical treatment of cancer of the stomach, he quite agreed with Dr. Mayo that laboratory methods of investigation are not yet as clearly developed and positive in their conclusions as could be wished, so far as rendering aid in doing an early operation. Medical men who are making this subject a specialty, as regards investigation of the contents of the stomach, as to the presence or absence of hydrochloric acid, the presence of lactic acid, the Boas bacillus, etc., are apt to procrastinate, and not infrequently the patient's chances are seriously interfered with by waiting too long before advising operation.

There is much truth in the remark that when once a tumor is felt, cancer of the stomach has become a very serious complication.

He quite agreed with Dr. Mayo that a clinical diagnosis can generally be made sufficiently correct to make it quite proper to advise a prompt operation. When once the abdominal cavity has been opened, and one is able to investigate the stomach carefully, then the extent of the glandular involvement should control largely as to a resection. He was quite positive that unless one made a complete removal of the infiltrated glands, and in doing a resection got well beyond the diseased portion of the stomach, or in doing a gastrectomy did it completely, some of the palliative operations were very much more desirable, and of greater service to the patient.

From a personal experience with quite a large number of

cases of gastric cancer he had seen great good result from a simple gastro-enterostomy or gastrostomy.

In pyloric stenosis, without many adhesions to the surrounding portions, and when it is plainly apparent that the lesion is non-malignant, he endorsed most earnestly Dr. Mayo's statement in regard to pyloroplasty.

Gastrojejunostomy had been with him a gratifying operation. It is certainly very pleasing to see the relief these patients obtain from this procedure from the perfect gastric drainage that is afforded.

Gastroduodenostomy had been with him a very difficult operation, and one that he had not done very frequently.

DR. J. M. T. FINNEY, of Baltimore, remarked, as to the treatment of pyloric stenosis of benign origin, that the solution of this problem could be expressed in one word, "Drainage," and this must be both permanent and effective. Any method, it seemed to him, that fulfilled these two requirements would be satisfactory; but it remains to be proven which is the best method.

At the present time, the advocates of gastro-enterostomy are certainly in the majority, both in numbers and professional eminence; but some of the other methods are or have been advocated by men whose opinions are worthy of consideration.

He had seen many cases of pyloric stenosis from one cause or another which had been much benefited by medical treatment, and a few in which the up-to-date physician had been able to avoid a surgical operation. He believed that if we were more careful in our methods of examination, if we studied our cases a little more closely for longer periods of time, and if we called in the aid of the physician more often, we would accomplish results, not as speedily perhaps, but in a way fully as satisfactory to the patient as if we rushed hastily into a surgical operation.

Early operation, certainly in the majority of cases, has many points to commend it; but in doubtful cases the surgeon should call to his aid the physician, and that speedily, and so should the physician call upon the surgeon, not perhaps with the idea of immediate operation, but in order that the case may be more intelligently and satisfactorily considered. He was an advocate of early operation in proper cases, but he could not subscribe to all that had been said in this respect. He believed, also, that

cocaine was a valuable agent in cases where, for any reason, the general anæsthetic is contraindicated in making an exploratory incision. He had used it frequently with the greatest satisfaction and had never seen any untoward results. The mortality in all operations upon the stomach is growing steadily less until now the mortality rate is extremely low.

As to operation for the relief of benign stenosis of the pylorus, the operation of pyloroplasty, after the Heineke-Mikulicz method, has not given general satisfaction, although in the hands of Von Mikulicz it had been productive of excellent results; but, as Dr. Mayo suggested in his paper, in the way in which it has been performed in this country, at any rate, it has been followed by a considerable number of recurrences.

The operation of pylorotomy must of necessity always be attended with a relatively high mortality, and for this reason it is only to be recommended in cancer. Dr. Finney had during the last two years performed pylorotomy eight times. He had followed practically the method of Hartman. Six of these cases made good recoveries from the operation and lived varying lengths of time; two or three are still living. It would seem, however, that so far as cure is concerned, from the nature and extent of the tissues affected and the lymphatic involvement which necessarily follows, that it is, and very likely always will be, next to impossible to eradicate entirely the cancerous growth, and that we must always look forward to a recurrence of the trouble, either locally or elsewhere. For this reason, the operation which offers the greatest amount of temporary relief at the least possible risk is the operation of choice.

In regard to gastro-enterostomy, he hesitated to say anything against it, because so much had been said in its favor by those whose opinion and experience were both greater and more weighty than his, but, unfortunately, the results of all surgeons, he was sure, were not the same as those they had listened to. Most surgeons had met all too frequently with unfortunate results after the employment of this operation. They are constantly meeting with cases which may have done well perhaps from the immediate operation, but which have later vomited themselves to death or have given other obstructive symptoms. Many efforts have been made to overcome the objections which have been urged, and which have made themselves evident after this

operation, and the satisfactory results reported by some of the previous speakers bore witness to the efficacy of their efforts, but the majority of operators had not had the same satisfaction.

Some of the objections that have been urged are inherent in the operation, and cannot be overcome as long as the operation is performed in the manner in which it is at present. Some of these objections may be more theoretical than practical, but it would seem that the normal position of the pylorus was the proper one, and any operation which preserves the normal relations is better than one which disturbs them.

Of course, the final test of an operation is what it does so far as the patient's health and comfort are concerned. Scientific observation of the work done by the stomach will throw a great light upon the relative value of the different methods.

Dr. Friedenwald, of Baltimore, had kindly made repeated chemical examinations of the stomach contents in five of his cases of pyloroplasty, in all of which it was found that, from very abnormal conditions before the operation, the patients had all returned to a practically normal condition in a comparatively short time after the operation.

With regard to the operation of pyloroplasty as suggested by himself at the Meeting of the American Surgical Association in Albany in 1902, and which it is unnecessary to describe again, this operation has this advantage over all operations in that it both makes the point of drainage at the lowest or approximately lowest point in the stomach and yet still preserves the normal relation. At the same time it is easy of accomplishment. It offers immediate relief to the patient in that the drainage is accomplished at once, and the outlet is so large as to make it very free. The after troubles are surprisingly little, and adhesions are no bar to the performance of the operation. It can be carried out in the presence of still active ulceration. He recently excised an ulcer on the posterior portion of the pylorus with very satisfactory result. It remains to be seen by a more extended use of the operation whether or not it is really the best at our disposal for the relief of benign stenosis of the pylorus. Of the thirty-eight cases which he had been able to collect, the mortality had been seven and one-eighth per cent.

EDITORIAL ARTICLE.

BLOOD-PRESSURE IN SURGERY AND THE TREATMENT OF SURGICAL SHOCK.

IN the essay by Dr. Crile, of Cleveland, to which the Cartwright Prize of the Alumni Association of the College of Physicians and Surgeons of New York City was awarded in 1903, and which has been published in book form,¹ is to be found a continuation of the author's experimental research into surgical shock published in 1897. The present research is an attempt to ascertain by scientific experimental methods the effects of various drugs and methods of treatment in preventing or antagonizing or correcting the conditions already established by the previous experiments as constituting surgical shock. The present volume is divided into two separate parts. In the first are given in detail the protocols of 251 experiments upon 243 animals. In the second part the experimental data obtained are summarized and the conclusions are stated. It is in this second part that the surgeon will find most of interest, all the more so since the questions studied are of primal importance, and the conclusions enunciated are in many instances in contradiction of widely accepted practice.

It is essential that the reader keep in mind the distinction, and a most important practical one it is, which the author makes between the immediate sudden depression which may result from cardiac failure, from hæmorrhage, or from injuries of the vasomotor centre, and the more gradually developed depression which

¹ BLOOD-PRESSURE IN SURGERY. By GEORGE W. CRILE, A.M., M.D., Professor of Clinical Surgery, Western Reserve Medical College. Philadelphia: J. B. Lippincott Company, 1903. Large 8vo, pp. 422.

is due to the exhaustion of the vasomotor mechanism; impaired cardiac and respiratory action, hæmorrhage, anæsthesia, temperature, may all contribute in some degree to the final result; but the important thing is the vasomotor breakdown from overstimulation. To the first described condition the term *collapse* is appropriate; here there is a suspension of function rather than an exhaustion of centres. To the second condition alone is the term *SHOCK* applied by Crile. Accepting, then, the author's statements that in shock the essential phenomenon is diminution of the blood-pressure, due to an exhaustion of the vasomotor centres, it is interesting to note the results of his experiments in the administration to animals suffering from shock of the drugs most commonly relied upon in surgical practice. Alcohol acted as a depressant; the more profound the shock the more marked was the depressing effect of alcohol. Nitroglycerin and amyl nitrite, also, were found to distinctly increase the rapidity of the decline in animals in deep shock. They increased shock instead of relieving it. Strychnine gave no better results; in any degree of shock, after the administration of a therapeutic dose of strychnine, the animals passed into deeper shock. Digitalis gave but little better results, for, although it usually caused a rise in the blood-pressure when given in various degrees of shock, it was found, however, that on the average cases of shock treated by digitalis did not live as long as the controls, that is, as long as similar animals under the same conditions to whom the drug was not given. This result seemed to be due to sudden cardiac failure from overstimulation. The author very justly remarks that there seems to be but a limited range of possibilities for heart stimulants in the condition of surgical shock. Stimulants acting upon the vasomotor, the cardiac, and other centres of the medulla are, on the whole, either inert or harmful.

The effects of adrenalin are more promising of good; in the normal animal in every degree of shock and collapse adrenalin administered intravenously caused a rise in the blood-pressure;

the force of the heart-beats was increased and the peripheral blood-vessels were contracted. But its effects are very transient, on account of the rapidity with which it is oxidized in the blood, so that its most effective method of administration was found to be by a continuous intravenous infusion in salt solution in strength of from 1 to 50,000 to 100,000. A burette, the rate of flow from which is controlled by a screw-cock attached to the rubber tube, may be used for its administration. Great caution must be exercised in its administration, for in an overdose it has a marked inhibitory effect upon the heart, and hence the circulatory phenomena should be under continuous observation. Whether it is a practical therapeutic agent, however, still remains to be established by its clinical use. Its inhibitory action upon the heart may be relieved by an injection of atropine.

Saline solution, intravenously or subcutaneously introduced, in every observation caused a rise in the blood-pressure, which was usually gradual, and was sustained in proportion to the degree of shock present. In the cases of moderate shock the gain in pressure was fairly well sustained; in deeper shock the rise was not so marked and not so well sustained; in case of the deepest shock the rise in the blood-pressure was not sustained beyond a certain time, even during the infusion. The solution is not retained in any considerable quantity in the blood-vessels, but is eliminated rapidly. Its range of usefulness is thus limited.

External pressure, as by bandages to the extremities, or by broadly applied pressure upon the abdomen, naturally suggests itself as a means of overcoming the accumulation of the blood in the veins resulting from vasomotor exhaustion, and of causing the blood to flow towards the heart. The real value of peripheral bandaging in raising and maintaining a rise in the blood-pressure was demonstrated in many of the experiments made. An ingenious device for the systematic application of external pressure was devised by the author, called by him a "pneumatic suit." This was constructed of a double layer of rubber cloth, enclosing

spaces to be inflated at will by a bicycle air-pump, whereby one or more of the limbs or the abdomen, separately or in any combination, might be subjected to pressure at will. The value of the apparatus to sustain the blood-pressure in conditions of shock, the author claims to have been strikingly demonstrated in repeated instances.

Morphine administered previous to the infliction of a traumatism, the author finds lessened to a considerable degree an animal's susceptibility to shock, and thereby made possible more extensive operations and procedures prolonged over a longer period of time. The clinical application of this finding is obvious.

The final summary of the author is as follows:

"In many instances the control of the blood-pressure is the control of life itself. Surgical shock is an exhaustion of the vasomotor centres. Neither the heart muscle, nor the cardiac centres, nor the respiratory centres are other than secondarily involved. Collapse is due to a suspension of the function of the cardiac, or of the vasomotor mechanism, or to hæmorrhage. In shock, therapeutic doses of strychnine are inert; physiologic doses are dangerous or fatal; if not fatal, increased exhaustion follows. Stimulants of the vasomotor centre are contraindicated. In shock, cardiac stimulants have but a limited range of possible usefulness and may be injurious. In collapse, stimulants may be useful because the centres are not exhausted. Saline infusion in shock has a limited range of usefulness; in collapse it may be effective. In shock it raises but cannot sustain the blood-pressure. Adrenalin acts upon the heart and the blood-vessels; it raises the blood-pressure in every degree of shock; it is rapidly oxidized by the solid tissue and by the blood; its effects are fleeting; it should be given continuously. In excessive doses there is a marked stimulation of the cardio-inhibitory mechanism; due caution must be exercised in its use; its clinical value still remains unproved."

The possible relationship of body temperature, either in the production of shock by its lowering, or in the prevention or

alleviation of shock by its elevation, does not seem to have as yet engaged the attention of Crile. Readers of the *ANNALS OF SURGERY* will doubtless recall the observations of Kinnaman on this point, as published in the December, 1903, issue of the *Journal*. In view of the conclusion of this last-named experimenter, that "temperature commands first place by its power of production, by its power of limitation, and by its power of amelioration of the composite condition,—shock," we shall look with interest for some future publication of Crile of results of his own experiments upon the effects of cold and heat upon shock. Kinnaman found that a rise of the temperature caused a rise in the blood-pressure and the respiratory rate (reduced in shock), with the result of a gradual amelioration of all the symptoms. If surgeons must abandon such time-honored agents as alcohol and strychnine, digitalis and nitroglycerin, in the treatment of shock, it will be a satisfaction to know that heat and friction are left to them.

It is obvious that in ordinary surgical work "pneumatic suits" are out of the question, while continuous infusions of adrenalin solutions are possible only in laboratory conditions. Saline infusions and subcutaneous injections are more generally practicable, and bandaging of the extremities is always available. It would appear as if these, with hot bottles and rubbings, were to constitute the therapeutic resources of the future against shock.

LEWIS S. PILCHER.

REVIEWS OF BOOKS.

THE PRINCIPLES AND PRACTICE OF SURGERY, Designed for Students and Practitioners. By GEORGE TULLY VAUGHAN, M.D., Assistant Surgeon-General, Public Health and Marine Hospital Service of the United States; Professor of the Principles and Practice of Surgery, Georgetown University, Washington, D. C. Philadelphia and London: J. B. Lippincott Company, 1903.

This volume is clearly written, its arrangement is good, it is up-to-date, and, for the most part, it presents only well established facts. The chapters on syphilis, aneurism, tuberculosis of the spine, and appendicitis are particularly to be commended for their concise and thorough exposition of the subjects discussed.

No mention is made of the use of the cautery in the treatment of anthrax, of the Matas method of arteriorrhaphy for aneurism, or of the simple and useful method of dry stretching of the nerve for sciatica.

Most surgeons would probably feel that they were not doing justice to their patients by giving saline infusions at a temperature of 100° F.; and they would scarcely choose to treat fractures of the shaft of the humerus by a method which has frequently resulted in non-union. The abdominal surgeon could hardly accept the unmodified statement that "the diagnosis of intestinal obstruction is not difficult," providing he hopes to make that diagnosis sufficiently early to effect a cure; and he would doubtless remind the author that small fæcal fistulæ do not heal if they lead to the small intestine.

At the present time it seems that there is a great demand for one-volume surgical treatises. While it may be seriously ques-

tioned if a work of 533 pages can adequately cover the subject of general surgery, even with the omission of such special branches as ophthalmology, gynæcology, etc., nevertheless, such a condensed text-book will be of special use to a student in his preparation for examination, and to the practitioner, who will regard it rather as an index to the progress of surgery than as a complete guide to diagnosis and treatment.

THOMAS BRAY SPENCE.

DAS GEWEBE UND DIE URSACHE DER KREBSGESCHWÜLSTE. Unter Berücksichtigung des Baues der einzelligen thierischen Organismen. Von DR. LUDWIG FEINBERG. Berlin: Verlag von August Hirschwald, 1903.

In this treatise the author maintains that in order to study the subject of the parasitic origin of the carcinomatous tumors, it is necessary to consider and understand the various forms of Protozoa. He wishes to show that from this consideration there may be deduced a general law, which applies not only to the single classes of one-celled animal organisms, but also to the entire group of Protozoa in general. That without discovering some such law, it is not possible to diagnose and classify any single-celled, isolated organism. He hopes that the deductions and conclusions which he is able to draw from the histological findings in the carcinomatous growths may also be found of value in explaining the etiology of Sarcomata and various skin diseases.

The work of other writers is often referred to. He holds that the lack of knowledge of the true characteristics of the Protozoa often gives rise to false conclusions. This he exemplifies in the case of some observers who have described as amœba certain cells found in the ascitic fluid in cases of carcinoma of the liver, basing their conclusions upon the amœboid movements which are seen. But these conclusions are only based upon false premises, for these same characteristics may be observed in free

cancer cells, freshly prepared, and examined in normal salt solution upon a heated stage.

The work is divided into two parts. Part I discusses the single-celled animal organisms. The Rhizopoda, Mastigophora, Sporozoa, and Ciliata are considered at length. The author goes into the minute structure of these organisms, paying especial attention to the structure of the nuclear body, the amount of chromatin contained, and its relation to the protoplasm. Then follows a comparison of these single cells with the normal tissue cells.

Part II is devoted to the tissue and the etiology of the carcinomatous growths. The author describes a single-celled animal organism as the etiological factor. This parasite he calls the *Histosporidium Carcinomatosum* n. g. n. sp., the nomenclature being based upon its histological resemblance to the Sporozoa, and its subclass the Neosporidia, and from the fact that the carcinomatous growth depends upon the presence of this parasite in the epithelial cells. There are two forms of this parasite, "die Form der Zellinfection" (parasite in the cell), and "die Form der diffusen Infiltration" (parasite between the cells). They represent two stages of the growth, *i.e.*, the development and the degeneration.

The author has attacked the subject in a thoroughly scientific manner, and his work deserves the attention of those interested in this line of research.

PAUL MONROE PILCHER.

ANATOMY OF THE BRAIN AND SPINAL CORD. By HARRIS E. SANTEE, M.D., Ph.D. Third Edition. Chicago: E. H. Colegrove, 1903.

This is the third revised and enlarged edition of this excellent book. The arrangement of the book is such that the student can best trace the conducting paths by the grouping and chaining of neurones. There is an orderly subordination of the minor

parts of the text. The different parts of the brain are displayed in connection with their physiological connections. The operculum and posterior part of the inferior frontal gyrus are shown with relation to their function as the centre of speech. Attention is similarly given to the ascending frontal, ascending parietal, and superior parietal convolutions as the best known motor areas of the cortex; also the temporal lobe as the probable seat of the centres of taste, smell, and hearing.

Comparative anatomy is also invoked to show the origin of the olfactory lobe in man and its antecedent in the lower animals.

The author shows the complex human brain as developed from a simple vesicular prototype. This book makes clear the paths of impulses, and enables the student to trace physiological functions through the nervous system.

In speaking of the various organs and parts of the nervous system, the author renders its identification more easy and its relations more simple by naming its function. Thus: "The pyramidal tracts are motor;" "Gower's tract probably carries thermic and pathetic impulses;" "Goll's column carries impulses of the muscular sense;" "All varieties of impulses are carried by Burdach's column;" "The direct cerebellar tract conveys impulses of equilibrium received especially from the viscera."

The author in the first edition used the old definition of neuron according to Waldeyer. He describes the neuron in this new edition as being a nervous entity, in the embryo structurally independent of all other neurones. In the adult their predominant relation continues to be that of contact. The different types of neurones are described and classified. The qualities peculiar to dendrites and axones are described and classified.

An elaborate and valuable table, giving the deep origin of the sensory nerves from their terminal nuclei, is furnished.

One chapter is devoted to the tracing of impulses through the better known paths formed by the various nervous groups.

These are treated under three headings: the motor, sensory (including general and special sense), and reflex.

The last chapter of the book is given to the embryology of the brain and spinal cord.

There are but few illustrations. The index is full and good. The book is interleaved with blank pages for the addition of notes.

JAMES P. WARBASSE.

CORRESPONDENCE.

CLOSURE OF ABDOMINAL WOUNDS.

EDITOR ANNALS OF SURGERY.

IN your November issue is a paper on "Abdominal Closure by a New Method," by Dr. J. F. Baldwin. The method consists in adding to the usual through-and-through sutures of all the layers a continuous, non-absorbable suture of the fascia, so placed as to be withdrawn at the same time the other sutures are removed.

Permit me to state that practically the same method was devised by me many years ago. It was given wide publicity more than five and a half years ago in a paper read before the Association of Baltimore and Ohio Railway Surgeons, and by its publication in the *New York Medical Record*, November 28, 1898.

If at this date, therefore, the term "new" can properly be employed, it must be with respect to the suture material used and not to the method.

ROBERT J. REED.

WHEELING, W. VA., December 1, 1903.

TO CONTRIBUTORS AND SUBSCRIBERS.

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